RESTRICTED

PRELIMINARY
INSTRUCTION BOOK

for

TBM-12
RADIO TELEGRAPH AND TELEPHONE TRANSMITTING EQUIPMENT

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
BALTIMORE, MD.

NAVY DEPT. BUREAU OF SHIPS

Contract NXsr-65327

Approved—10 April, 1945

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CHANGE NO.	DATE	SIGNATURE OF OFFICER MAKING CORRECTION

26 April 1945
1 Sheet

Addenda No. 1

TBM-12

The following resistors have had their resistance values changed to conform with RMA and JAN-R-11 specifications:

Symbol	Resistance Value Shown in Parts List	RMA Resistance Value as Supplied
R-404	25,000 ohms	24,000 ohms
R-405	50,000 ohms	51,000 ohms
R-412	5 megohms	5.1 megohms

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CONTRACTUAL GUARANTEE

The equipment, including all parts and spare parts, except vacuum tubes, batteries, rubber and material normally consumed in operation, is guaranteed for a period of one year from the date of delivery of the equipment to and acceptance by the Government with the understanding that all such items found to be defective as to material, workmanship or manufacture will be repaired or replaced, f.o.b. any point within the continental limits of the United States designated by the Government, without delay and without expense to the Government; provided such guarantee will not obligate the Contractor to make repair or replacement of any such defective items unless the defect appears within the aforementioned period and the Contractor is notified thereof in writing within a reasonable time and the defect is not the result of normal expected shelf life deterioration.

To the extent the equipment, including all parts and spare parts as defined above, is of the Contractor's design or is of a design selected by the Contractor, it is also guaranteed, subject to the foregoing conditions, against defects in design with the understanding that if ten per cent (10%) of any such said item, but not less than two of any such item, of the total quantity comprising such item furnished under the contract, are found to be defective as to design, such item will be conclusively presumed to be of defective design, and subject to one hundred per cent (100%) correction or replacement by a suitably designed item.

All such defective items will be subject to ultimate return to the Contractor. In view of the fact that normal activities of the Naval Service may result in the use of the equipment in such remote portions of the world or under such conditions as to preclude the return of the defective items for repair or replacement without jeopardizing the integrity of Naval communications, the exigencies of the Service, therefore, may necessitate expeditious repair of such items in order to prevent extended interruption of communications. In such case the return of the defective items for examination by the Contractor prior to repair or replacement will not be mandatory. The report of a responsible authority, including details of the conditions surrounding the failure, will be acceptable as basis for affecting expeditious adjustment under the provisions of this contractual guarantee.

The above period of one year will not include any portion of time the equipment fails to perform satisfactorily due to any such defects, and any items repaired or replaced by the Contractor will be guaranteed anew under this provision.

INSTALLATION RECORD

Contract NXsr-65327, Dated June 20, 1944

Serial Number of equipment.....

Date of acceptance by the Navy.....

Date of delivery to contract destination.....

Date of completion of installation.....

Date placed in service.....

Blank spaces on this page shall be filled at the time of installation. Operating personnel shall also mark the "date placed in service" on the date of acceptance plate located below the model nameplate on the equipment, using suitable methods and care to avoid damaging the equipment.

REPORT OF FAILURE

Report of failure of any part of this equipment, during its service life, shall be made to the Bureau of Ships in accordance with current instructions. The report shall cover all details of the failure and give the date of installation of the equipment. For procedure in reporting failures see Chapter 67 of the "Bureau of Ships Manual," or superseding instructions.

ORDERING PARTS

All requests or requisitions for replacement material should include the following data:

1. Navy stock number or, when ordering from an Army supply depot, the Army stock number.
2. Name of part.

If the Navy stock number has not been assigned, the requisitions should specify the following:

1. Equipment model designation.
2. Name of part and complete description.
3. Manufacturer's designation.
4. Contractor's drawing and part number.
5. AWS, JAN, or Navy type designation.

WARNING

The attention of officers and operating personnel is directed to Chapter 67 of Bureau of Ships Manual or superseding instructions on the subject of Radio-Safety precautions to be observed. While every practicable Safety precaution has been incorporated in this equipment, the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS. Operating personnel must at all times observe all safety regulations. Do not change tubes or make adjustments inside equipment with high voltage supply on. Under certain conditions dangerous potentials may exist in circuits with power controls in the off position due to charges retained by capacitors. To avoid casualties always remove power and discharge and ground circuits prior to touching them.

DON'T SERVICE OR ADJUST ALONE. Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS. Do not depend upon door switches or interlocks for protection but always shut down motor-generators or other power equipment. Under no circumstances should any access gate, door or safety interlock switch be removed, short circuited, or tampered with in any way, by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

RESUSCITATION

AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR OR SONAR ENCLOSURE. POSTERS MAY BE OBTAINED UPON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.

SECTION I

PREFACE

1. TRANSMITTER, GENERAL.

a. The Navy Model TBM-12 Radio Telegraph and Telephone Transmitting Equipment has been designed for installation and operation on all types of Navy vessels, with the exception of certain types of submarines. It consists of a Transmitter Unit, Navy Type CAY-52218, a Magnetic Controller Unit, Navy Type CAY-211232, a Motor-Generator Unit, Navy Type CAY-21676 and a Modulator Unit, Navy Type CAY-50065-B.

b. The transmitter unit covers a frequency range of 2000 to 18100 kilocycles with a nominal CW telegraph power output of 500 watts. Provisions have been made for disconnecting the final power amplifier to permit low power CW telegraph operation with a nominal power output of 75 watts in the frequency range of 2000 to 9050 kilocycles. The design of the transmitter unit is based on the master oscillator-intermediate amplifier-power amplifier principle. The transmitter frequency, as controlled by the master oscillator, is continuously variable in the specified frequency band. The TBM-12 equipment is supplied with a modulator which permits voice or MCW transmissions modulated up to 100 per cent with a nominal power output of 350 watts.

c. Telegraph keying speeds up to 100 words per minute on CW telegraph transmissions, and up to 50 words per minute on MCW telegraph transmissions, may be utilized. On voice transmissions the transmitter may be controlled manually or by a voice operated relay in the modulator unit.

d. When using CW or MCW transmission, the TBM-12 transmitter may be controlled locally or from a remote point by means of a standard Navy Type 23005 4-wire control or by a Navy Type 23146 6-wire control. On voice transmissions the transmitter may be controlled locally, or from a remote point by means of a Navy Type CRV-23172, CRV-23211, CW-23071 or CW-23072 radiophone unit. The radiophone units, and the 4-wire or 6-wire remote control units are not supplied as a part of the TBM-12 equipments. Minor circuit changes, easily made at the time of installation, permit adapting the equipment for either 4-wire or 6-wire control.

e. The control circuit for the equipment is drawn from the D.C. supply line and the control circuit relays in the equipment are D.C. operated. In the TBM-12 230 volt D.C. equipments resistors are inserted in series with the relay circuits to drop the relay operating voltages to their proper voltage.

2. MODULATOR, GENERAL.

a. The Navy Type CAY-50065-B modulator unit is designed for installation and operation with several different types of transmitters. It is composed of apparatus necessary for taking power from a motor-generator set and modulating the transmitter by either tone or voice.

b. The modulator is essentially a three stage push-pull amplifier. Provision is made for transmission by either CW, MCW or VOICE. The design of the modulator is such that, when supplied with speech input at a 6 milliwatt level from a 600 ohm source, it will be capable of effecting 100 per cent plate modulation of the transmitter with an audio frequency distortion of less than 10 per cent. The modulator is a single self-contained unit, complementary to the transmitter unit, and similar to it in general construction and appearance. All necessary operating controls are located on the front panel and are electrically "dead."

c. The gain of the modulator is approximately 60 db. Approximately 400 watts are available for modulation purposes from the final amplifier, over the audio frequency range of 100 to 5000 cycles. The same output power is available for MCW operation. Modulation frequency in this case is 800 cycles and is obtained from an audio oscillator in the modulator unit. The modulator has been designed for operation on any one of the following types of power supplies:

Modulator Unit Type CAY-50065-B
- 115 Volts, D.C. $\pm 10\%$
- 230 Volts, D.C. $\pm 10\%$
- 220 Volts, 3 Phase, 60 Cycles
- 440 Volts, 3 Phase, 60 Cycles
- 220 Volts, 1 Phase, 60 Cycles

This book, however, will deal only with the type power supply intended to be used with the TBM-12 equipment, *i.e.,* the 230 volt D.C. power supply.

3. POWER SUPPLY, GENERAL.

a. The power supply supplied with the TBM-12 equipment consists of a Navy Type CAY-21676 motor-generator and a Navy Type CAY-211232 magnetic controller. This power is designed to convert the available supply line power to suitable D.C. power for the operation of the transmitter unit, and the modulator unit when used.

b. The Type CAY-21676 motor-generator supplied with the TBM-12 equipments is of the three unit, six bearing type. All three units are mounted on a cast steel bedplate in such a manner that any unit may be

removed from the bedplate without necessitating the removal of any other unit. The units are coupled together with flexible couplings and are fitted with self-aligning ball bearings. The motor-generator consists of two D.C. generators and a driving motor. The low voltage generator supplied with this motor-generator unit is a Navy Type CAY-21679 while the high voltage generator is a Navy Type CAY-21680 and the driving motor is a Navy Type CAY-21681.

c. The magnetic controller unit supplied as a part of the TBM-12 equipment is of the remote controlled, drip proof, protected magnetic contactor type. All of the contactors, relays and resistors associated with the controller are assembled on an insulated panel and mounted in a sheet steel box.

d. Power required from the supply line for this equipment for locked key operation is 5.7 kilowatts. The maximum allowable supply line variation in voltage is $\pm 10\%$.

4. WEIGHTS AND DIMENSIONS

a. The Navy Model TBM-12 Radio Telegraph and Telephone Transmitting Equipment is comprised of the units listed below. The following information includes the weights and dimensions of the various units both uncrated and crated for shipment:

(1) Radio Transmitter Unit, Type CAY-52218

	Uncrated	Crated
Height	72″	77½″
Width	32″	38¼″
Depth	24″	30½″
Weight	780 lbs.	1030 lbs.

(2) Modulator Unit, Type CAY-50065-B

	Uncrated	Crated
Height	72″	76½″
Width	18″	24¼″
Depth	24″	30″
Weight	385 lbs.	580 lbs.

(3) Motor Generator Unit, Type CAY-21676, consisting of:
D.C. Motor, Type CAY-21681
High Voltage D.C. Generator, Type CAY-21680
Low Voltage D.C. Generator, Type CAY-21679

	Uncrated	Crated
Height	20¼″	27″
Length	78-13/16″	80″
Width	20¼″	25″
Weight	1225 lbs.	1475 lbs.

(4) Magnetic Controller, Type CAY-211232

	Uncrated	Crated
Height	20¼″	28″
Width	15″	25½″
Depth	10-13/32″	17¾″
Weight	68 lbs.	123 lbs.

SECTION II

DESCRIPTION

5. TRANSMITTER UNIT.

a. GENERAL.

(1) The Navy Model TBM-12 Radio Telegraph and Telephone Transmitting Equipment utilizes a Type CAY-52218 High Frequency Transmitter Unit. This transmitter is suitable for resonating antennas having characteristics which fall within the following limits:

(a) Maximum antenna trunk length....35 feet

(b) Minimum antenna trunk length...No trunk

(c) Diameter of trunk, if used.....8 to 12 in.

(d) Maximum distance of transmitter from inner end of trunk or entering insulator..20 feet

(e) Minimum distance of transmitter from inner end of trunk or entering insulator...2 feet

(f) Maximum length of antenna outside trunk .....80 feet

(g) Minimum length of antenna outside trunk, sufficient to permit efficient radiation of energy .....

(2) Under the above conditions the high frequency transmitter will deliver the power listed in the following table, using a Navy Type —861 tube as the final amplifier.

Freq. Kcs.	Antenna Cap. Mmfd.	Antenna Res. Ohms	Power Output Watts CW
2000	*	*	500
3000	*	*	500
3500	*	*	475
4000	*	*	475
4500	*	*	450
6000	*	*	450
7500	*	*	400
9050	*	*	375
12000	*	*	360
16000	*	*	325
18100	*	*	300

*500 Watt, 110 V. Mazda "C" Lamp, practically non-reactive resistance between antenna terminal and ground.

(3) Reference to the drawings listed below will facilitate an understanding of following description of the transmitter unit.

Title	Figure	Drawing
Outline and Mtg. Dimensions	26	T-7611719
Schematic Diagram	19	W-7300875
Wiring Diagram	21	W-7300446

(4) The circuits in the radio transmitter unit include a self-excited master oscillator, using a Type —860 tube, a first intermediate amplifier using a Type —860 tube, a second intermediate amplifier using a Type —860 tube, a power amplifier using a Type —861 tube and an antenna tuning system arranged for either current or voltage feed to the antenna. Two tube access doors are provided, one for the master oscillator tube and the other for the amplifier tubes. One access door is provided for the terminal board and relays. All these doors are provided with interlocks which will remove all power (except line voltage and master oscillator heater system power) from the transmitter unit if any door is opened.

(5) For description convenience the transmitter unit may be divided into the following seven sections:

(a) Terminal board and relay section

(b) Master oscillator

(c) First intermediate amplifier

(d) Second intermediate amplifier

(e) Power amplifier

(f) Antenna tuning and coupling section

(g) Power and control switches

Each of these sections will be described in detail.

b. TERMINAL BOARD AND RELAY PANEL.

(1) The terminal board and relay panel are located at the bottom of the transmitter unit and may be made accessible by opening an access door on the lower front panel. This door is suitably interlocked with the control circuits and held in place by two door latches. All external control and power wiring, with the exception of the antenna lead, is connected to this terminal board. Antenna connection is made at the top of the unit and is accessible through a hole in the top shield, see Fig. 26. Mounted on the relay panel are field contactor K-9 on the left and starting contactor K-4 on the right. In the center, and in order from left to right, are H.V. overload relay K-5, M.O. plate overload relay K-7 and compensator relay K-2, see Fig. 2.

(2) Behind the terminal board panel are mounted the filament transformer T-1 and the M.O. filament transformer T-12. Also mounted behind the terminal board are the keying filter choke L-16, M.O. plate and screen voltage filter capacitor C-47, H.V. filter capacitor C-65, grid bias filter capacitor C-48, 2000 volt filter capacitor C-58, bias potentiometer resistors R-1, R-19, R-21 and R-29, M.O. screen grid resistor R-2, M.O. plate resistor R-3, H.V. potentiometer resistors R-15, R-16, R-45, R-46, R-47 and R-48.

c. MASTER OSCILLATOR.

(1) On the left side of the transmitter is the master oscillator which is mounted within the transmitter as a separate unit. It is 35½ inches high, 12½ inches wide and 22 inches deep. This complete unit may be removed from the transmitter for servicing. The master oscillator is mounted with springs and snubbed by means of sponge rubber cushions in such a manner that very little vibration is transmitted from the transmitter frame to the master oscillator unit.

(2) The master oscillator uses a Type —860 tube in an electron coupled circuit which has its tank circuit inductance and capacitance mounted in a temperature controlled compartment in the upper part of the master oscillator unit. This compartment requires approximately three hours to come up to temperature, after which it is held at an approximate constant temperature of 60 degrees C. The temperature is controlled by mercury-type thermostat S-13, which is set for 60 degrees C., and thermostat relay K-20. Relay K-20 is operated from potentiometer resistor R-57 which is connected across the 230 volt D. C. blower motor supply. Temperature protection switch S-11, in the form of a "Westinghouse Watchman," is connected in series with thermostat relay contacts K-20B and disconnects the heater circuit in case the temperature should rise above 70 degrees C. due to failure of any temperature controlling device. A spark filter, consisting of C-60, R-49 and R-58, is connected across switch S-11 and thermostat relay contacts K-20B. A spark filter, consisting of R-50, is connected across the contacts of S-13. For a better understanding of these circuits see the schematic diagram, Fig. 19.

(3) Blower motor B-1, located directly above the master oscillator unit, circulates the air constantly within the master oscillator tank circuit compartment. This maintains all the frequency determining components of the circuit at a practically constant temperature. Resistor R-7 in the transmitter unit is used to drop the line voltage to 115 volts for operation of the blower motor.

(4) Also located in the constant temperature box is compensating capacitor C-62. This capacitor consists of a bi-metallic device which is connected into the circuit in such a manner that it compensates for the effect of variable tube capacity due to tube heating when the master oscillator tube is in operation. The bi-metal is actuated by current from compensator transformer T-3, which is supplied with power through contact K-2B of the compensator relay. *Do not make any adjustment on compensating capacitor C-62. This capacitor has been set correctly at the factory and no adjustment is needed.*

(5) The cover for the master oscillator heat compartment is fitted with a paper gasket. This has been done to provide good contact at definitely known points only; namely, at the screws; *and to eliminate unknown contact elsewhere.*

(6) Thermostat relay K-20 and thermostat resistor are located directly above the master oscillator unit. The lower right hand compartment of the master oscillator unit contains the master oscillator doubler circuit, which is always tuned to a frequency that is double the frequency of the master oscillator.

(7) The electron-coupled circuit, as used in the master oscillator, is shown complete in the schematic diagram. Referring to this diagram, Fig. 19, the tuned circuit consists of the variable tapped master oscillator tank capacitors, C-1, C-2, C-3 and C-56. This circuit covers the frequency band of 1,000 to 2,262.5 kcs. Tuning is accomplished by the selection of proper coil taps by MASTER OSCILLATOR RANGE switch S-1, control A, and by moving a copper cylinder inside the coil, control B. In order to avoid neutralizing the master oscillator plate circuit, the screen grid is tied to ground through master oscillator screen by-pass capacitor C-6, and the tube filament is operated at a radio frequency potential above ground. The master oscillator filament choke L-2 prevents the radio frequency filament potential from leaking off to ground through the M.O. filament transformer T-12. M.O. filament by-pass capacitors C-8 and C-9 by-pass the filament and provide a mid-tap for connecting the filaments to the tank circuit. The master oscillator screen resistor R-2 drops the potential on the screen grid, which is used as an anode in this circuit, to approximately 300 volts. Master oscillator plate power is supplied to the tube through master oscillator plate resistor R-3 and the radio frequency master oscillator plate Choke L-4. The master oscillator plate resistor R-3 reduces the 1,000 volt plate supply to approximately 700 volts. For this particular application of the Type —860 tube, values of *approximately 300 volts for the screen grid and 700 volts for the plate are the optimum operating voltages* necessary to obtain maximum frequency stability regardless of variations in supply voltage. Master oscillator plate choke L-4 prevents the radio frequency plate power from leaking to ground through master oscillator plate resistor R-3 and the 1,000 volt supply. The doubler circuit coupling capacitor C-13 blocks off D.C. plate potential and also couples the master oscillator to the doubler circuit. This circuit consists of the variable DOUBLER CIRCUIT TUNING capacitor C-14, control C, and the doubler tank coil L-3. The circuit is always tuned to the second harmonic of the oscillator, i.e., tuned to frequencies in the 2000 to 4525 kcs. band. Therefore, grid excitation is provided for the first intermediate amplifier through the first intermediate grid coupling capacitor C-15. A stop has been provided at the high frequency end of the MASTER OSCILLATOR TUNING, control B, which is effective on the eight ranges of the MASTER OSCILLATOR RANGE switch, control A, so that proper frequency range and overlap are obtained. This stop is set at such a position that a maximum dial setting of 5000 divisions is obtained. The stop is attached to the threaded shaft on which the copper cylinder in the

M.O. tank coil L-1 travels. It determines the limit of clockwise rotation of MASTER OSCILLATOR TUNING, control B.

(8) The following is a brief explanation of the electron coupled oscillator circuit. In order to more easily understand the circuit, reference is made first to the standard Colpitts oscillator circuit, shown in Fig. 42, Dwg. 7705422. In this circuit coil L-1 and capacitors C-1 and C-2 form the tank circuit which operates at a frequency "f."

(9) M.O. tank capacitors C-1 and C-2 are of such a value as to give the correct voltage distribution to the plate and grid for proper operation. Generally, C-1 is approximately four times as large as C-2. C-3 is the grid blocking capacitor. The grid receives its bias by action of grid leak resistor R-1. C-4 is the plate blocking capacitor and the high voltage is fed to the plate through radio frequency choke RFC-1. The output frequency is the same as that of the tank circuit "f."

(10) Referring to the electron coupled oscillator circuit shown in Fig. 42, Dwg. P-7705422, it can be seen that the circuit is very similar to the Colpitts circuit using a three element tube. The exception is that the screen grid of the four element tube takes the place of the plate. The tank circuit is again composed of inductance L-1 and capacitors C-1 and C-2, and operates at a frequency "f." In order to obtain the shielding action of the screen grid, the screen grid end of the tank circuit is grounded instead of the filament. This operates the filament at radio frequency potential, and necessitates the use of radio frequency chokes RFC-2 and RFC-3 in the filament leads to transformer T-1. It should be noted that capacitors C-1 and C-2 have been interchanged, placing the high radio frequency potential on the grid instead of the screen grid. This causes the output frequency to be high in harmonic content. This is an advantage which will be described later.

(11) The plate of the tube is connected through to the output circuit in the same manner as in the Colpitts circuit. The plate, however, does not receive its energy from the oscillator circuit in the usual manner of capacity coupling or direct connection. The grounded screen prevents capacity coupling. Since the electron flow to the plate must pass through the screen grid, the screen modulates the plate current at radio frequency "f." The desired A.C. in the plate circuit is then built up across the impedance offered by choke RFC-1. This method of coupling is called electron coupling, and is highly advantageous since any change made in the output circuit reflects only very slightly on the tank circuit and does not shift the frequency. As previously described, the output frequency is rich in harmonics. This allows a doubling circuit composed of L-2 and C-7 to be connected to the plate and operated at twice the frequency of the main tank circuit or "2f." This further reduces the effect of any variation in the circuits attached to the output.

(12) It has been found with the electron coupled circuit that if screen grid voltage is held constant, and plate voltage is varied, the frequency decreases as the plate voltage is increased. Conversely, if plate voltage is held constant, and screen grid voltage is varied, the frequency increases as the voltage is increased. The two curves can be made approximately equal and opposite by proper proportioning of the circuit and operating voltages. Then, if the screen grid and plate are connected to the same potential, and series resistors used to obtain the correct operating voltages, any change in the supply voltage causes only a very small amount of shift in the output frequency. The resistors which accomplish this are R-2 and R-3.

d. FIRST INTERMEDIATE AMPLIFIER.

(1) The first intermediate amplifier is located in the lower right hand compartment of the transmitter unit. This amplifier is used to prevent reaction on the master oscillator by the second intermediate and power amplifiers. For transmitter output frequencies of 2000 to 4000 kcs., the first intermediate amplifier is operated as a fundamental or straight through amplifier at the frequency of the M.O. doubler circuit, L-3 and C-14, control C. For the transmitter output range of 4000 to 9050 kcs., the first intermediate amplifier, L-7 and C-21, control D, is operated as a frequency multiplier to double the output frequency of the master oscillator doubler circuit, *i.e.,* functioning at four times the frequency of the M.O. tank circuit. When the first intermediate amplifier is used as a frequency doubler, the FREQUENCY RANGE switch S-2E, control L, is closed, shorting out approximately half the turns in tank coil L-7. The Type 860 tube in this stage obtains its grid excitation from the tuned output circuits of the master oscillator doubler circuit through capacitor C-15. Grid choke L-6 offers a high impedance path for the radio frequency grid voltage to ground. At the same time, it allows a blocking bias to be applied to the tube grid from bias potentiometer R-19, R-21 and R-28. Capacitor C-16 protects the potentiometer and bias circuit from any transient radio frequency potential. Resistor R-25 provides an operating bias in addition to that normally supplied by bias potentiometers R-19, R-21 and R-28. The tuned plate circuit consists of the FIRST INTERMEDIATE AMPLIFIER TUNING capacitor C-21, control D, and tank coil L-7. Filament by-pass capacitors C-17 and C-18 by-pass the filament and effectively ground it for R.F. Capactor C-20 grounds one end of the plate tank circuit for R.F. The first intermediate amplifier R.F. plate choke L-5 is used to prevent any radio frequency energy from getting back to the plate voltage supply.

(2) Screen grid potential for this stage is obtained from a potentiometer consisting of resistors R-15, R-16, R-45, R-46, R-47 and R-48 which are connected across the terminals of the 2000 volt supply. Screen resistor

R-8, in series with the screen, further reduces the screen grid potential by the amount of screen grid current flowing through it. Operation is also improved by providing screen grid voltage. The screen grid is effectively grounded for radio frequencies by the first intermediate amplifier screen grounding capacitor C-19.

e. SECOND INTERMEDIATE AMPLIFIER.

(1) The second intermediate amplifier is located immediately above the first intermediate amplifier. For transmitter output frequencies of 2000 to 9050 kcs., the amplifier is operated as a fundamental or straight through amplifier. This amplifier may also be used as a final amplifier over the range by operation of HIGH-LOW POWER switch S-3, S-4 and S-5. This switch disconnects the 500 watt power amplifier tube and transfers the antenna circuit to the second intermediate amplifier. When the second intermediate amplifier is functioning as the final amplifier, an output of approximately 75 watts is obtained. For output frequencies of 9050 to 18100 kcs., the second intermediate amplifier is operated as a frequency doubler and excites the power amplifier.

(2) R.F. grid choke L-8 offers a high impedance for the radio frequency grid voltage to ground. At the same time, it allows a blocking bias to be applied to the tube grid from bias potentiometers R-19, R-21 and R-28. Capacitor C-25 protects the potentiometer and bias circuit from any transient radio frequency potential.

(3) The tuned plate circuit of the second intermediate amplifier consists of a continuously variable second intermediate amplifier tank coil L-9, a variable SECOND INTERMEDIATE AMPLIFIER TUNING capacitor C-29, control E, and a fixed mica second intermediate amplifier tank capacitor C-53. The mica capacitor is placed in the circuit by means of FREQUENCY RANGE switch S-2D for the transmitter output of 2000 to 4000 kcs.

f. POWER AMPLIFIER.

The power amplifier is located in the upper right-hand compartment of the transmitter unit and is similar in construction to the second intermediate amplifier except that a Type —861 tube is used. Switches are provided for disconnecting the filament, grid, screen grid, and plate potentials from the tube when the transmitter is operating on low power (75 watt output). The power amplifier operates as a fundamental or straight through amplifier over the entire frequency range of 2000 to 18100 kcs. For the frequency range of 2000 to 4000 kcs., the FREQUENCY RANGE switch S-2B inserts a fixed P.A. tank capacitor C-54 in parallel with POWER AMPLIFIER TUNING capacitor C-39 in the power amplifier tank circuit. See switches S-3, S-4 and S-5 on the schematic diagram, Fig. 19, Dwg. W-7300875.

g. ANTENNA TUNING AND COUPLING SECTION.

(1) The antenna tuning circuits and KEYING RELAY K-1 occupy the entire top compartment of the transmitter unit. The antenna tuning system is made up of ANTENNA COUPLING capacitor C-41, ANTENNA TUNING INDUCTANCE L-13, ANTENNA CURRENT-VOLTAGE FEED switch S-6, ANTENNA TUNING CAPACITOR C-42, and ANTENNA CURRENT ammeter M-1.

(2) ANTENNA TUNING CAPACITOR C-42 is variable and is operated in parallel with the variable ANTENNA TUNING INDUCTANCE L-13 for VOLTAGE FEED and in series with L-13 for CURRENT FEED to the antenna. The transmitter antenna terminal is located at the top of the unit and is accessible through a hole in the top shield.

(3) KEYING RELAY K-1 is located in this compartment. Contacts K-1C key the master oscillator by opening the ground side of the high voltage plate supply to the Type —860 tube. Contacts K-1C are shunted by KEYING RELAY arc suppressor capacitor C-45 in series with KEYING RELAY arc suppressor resistor R-4. This combination is connected in series with keying filter choke L-16 to reduce arcing, and resultant key clicks, to a minimum. The amplifier stages are operated Class C and, therefore, are supplied with a bias voltage of sufficient value to block the tubes when no excitation is supplied by the master oscillator. Contacts K-1D of the KEYING RELAY are connected to the terminal board and are used for keying an audio oscillator located in the modulator unit, Type CAY-50065B. Contacts K-1B and K-1E of the KEYING RELAY are wired to the terminal board for use in operation of associated receiver attenuator relays. Contact K-1B is a normal "make" contact and may be used for energizing a receiver attenuator relay when the transmitter key is closed. Contact K-1E is a normal "break" contact and may be used to control a receiver attenuator relay which must be de-energized when the transmitter key is closed. When these contacts are used in connection with receiver attenuator relays, suitable spark suppression circuits (capacitor and resistor combination) should be incorporated externally to the transmitter to completely eliminate sparking at the relay contacts for the specific load that they are handling.

(4) The coil of the compensator relay K-2 is energized whenever the coil of KEYING RELAY K-1 is energized. Closing of the contacts of compensator relay K-2 controls power to the compensator capacitor C-62. This capacitor maintains frequency stability of the M.O. for key up or key down conditions.

b. POWER AND CONTROL SWITCHES.

(1) The control switches and indicating lamps are located on a panel directly above the master oscillator unit. The control switches are as follows: TEST key S-10; START-STOP switch S-8 or S-17 (4- or 6-wire control switch); REMOTE-LOCAL switch S-7; TUNE-OPERATE switch S-9 and EMERGENCY SWITCH S-12.

(2) TEST key S-10 is of the two section toggle type and accomplishes the same function as the remote telegraph key. It will key the transmitter when placed in the up or down position. When placed in the up position it will automatically lock in that position. When pushed down, it will reset to the middle, or off, position as soon as it is released. When in the up or down position, TEST key S-10 energizes the coil of the KEYING RELAY K-1.

(3) START-STOP switch S-8 or S-17 is used to start or stop the motor-generator unit supplying power to the transmitter. Two START-STOP switches are provided to allow the use of either a 4- or 6-wire remote control system with the equipment. Switch S-8 is to be used with the 4-wire control system and switch S-17 is to be used with the 6-wire control system. All transmitter units are wired for 6-wire remote control systems at the factory. Minor circuit changes, easily made at the time of installation, permit the use of the switch with either 4- or 6-wire control; see Paragraph 13*a* for this information. Link switches S-18, S-20 and S-21 are provided to permit rapid selection of circuits for either 4- or 6-wire control. Rapid installation of the proper START-STOP switch S-8 or S-17 is made possible by connecting it to a small terminal block directly under the switch. Properly marked leads are attached to each switch to facilitate easy and correct wiring. The circuits for use with S-8 and S-17 will be described separately below:

(a) In the 4-wire control system one side of the key circuit and one side of the START-STOP switch circuit are common. The type of switch used for starting and stopping the equipment is a double pole, single throw, lock-in push button type connected in series with the starting contactor K-4 solenoid. With switch S-8 closed the equipment is in operation and will continue to operate until the starting contactor solenoid circuit is broken by opening S-8.

(b) In the 6-wire control system, the starting circuit and keying circuit are entirely separate and the START-STOP switch is of the momentary push button type more commonly used for control of large electrical equipment. START-STOP switch S-17, used for this system, consists of two normally open switches, S-17A and S-17B, which control the operation of the equipment over three control wires as follows: In this system contactor K-4 must operate with impedance, R-34, in series with its operating solenoid. The START portion S-17A is connected in series with starting contactor solenoid K-4A. Momentarily closing S-17A closes contactor K-4. Contact K-4B immediately interlocks or parallels S-17A so that, upon releasing S-17A, the solenoid circuit remains closed and the equipment stays in operating condition. To stop the equipment, contactor K-4A solenoid is shorted by the STOP portion S-17B of the START-STOP switch S-17, thereby causing the contactor to open. Contact K-4B immediately breaks the holding circuit of the contactor and remains open. The equipment then shuts down until the START switch button is again closed. Resistor R-34 prevents the line from becoming short-circuited when the STOP button S-17B is closed.

(4) REMOTE-LOCAL switch S-7 on the transmitter unit is used to switch control of the transmitter to the 4- or 6-wire remote control units and/or the radiophone units.

(5) TUNE-OPERATE switch S-9 is intended for use as its name implies. It has three positions; the first, labelled TUNING STEP 1, is for use in making the adjustments of the master oscillator. When the switch is in this position, the plate voltage is removed from all of the amplifier stages. In the second or TUNING STEP 2 position, the plate potential is applied to all amplifier stages but at a safe value for tuning. In the third, or OPERATE position, the plate potential is increased to the operating value determined by the position of GENERATOR FIELD rheostat R-33 on the transmitter.

(6) EMERGENCY SWITCH S-12 is used to shut down the complete equipment in case of an emergency. S-12 opens both sides of the control circuit power supply line, thus de-energizing all relays and shutting down the equipment.

(7) Indicator lights are provided as follows: Reading from left to right: STARTING SOLENOID I-2 (red), PLATE VOLTAGE I-3 (red), HEATER CIRCUIT I-5 (amber), BIAS VOLTAGE I-1 (green) and M.O. FILAMENT I-4 (clear).

(8) In order to permit rapid adjustment of the master oscillator to any desired frequency within its range, provisions have been incorporated in the transmitter for connection of a standard frequency measuring equipment, such as Model LD. On the left side of the tuning chart is located the FREQUENCY METER AUDIO OUTPUT jack J-1, making the output from the frequency meter available at the transmitter, adjacent to the frequency determining controls.

6. MODULATOR UNIT.

a. GENERAL.

(1) The Navy Type CAY-50065-B Modulator Unit contains, in a single frame, the necessary electrical circuits, tubes and control apparatus for taking power

from a motor-generator set and delivering audio power for modulation of the transmitter unit. Meters, controls, indicating lights, switches, etc., are mounted on, and are accessible from, the front panel. Two hand rails, similar to those on the transmitter unit, are furnished on the modulator. A door on the front panel permits access to the vacuum tube shelf. A similar door is provided at the bottom of the set for access to the terminals. Interlocks are provided on the access doors to prevent personnel from coming in contact with high voltages. All side, top and back shields are removable by means of thumb screws.

b. MECHANICAL.

(1) The mechanical features of the modulator may be seen by referring to the outline drawings and photographs in Section VIII. In addition to the meters and controls, there is a telephone handset and hook switch on the front panel so as to make LOCAL control readily available. The controls located on the front panel may be identified by reference to Fig. 10. At the top of the frame is a panel on which are assembled six meters in two horizontal rows of three each. In the top row, from left to right, are the MODULATOR PLATE CURRENT meter M-403, MODULATOR PLATE CURRENT meter M-404 and PERCENTAGE MODULATION meter M-405. In the second row in the same order are the INPUT AMPL. PLATE CURRENT meter M-401, INT. AMPL. PLATE CURRENT meter M-402 and the FILAMENT VOLTAGE meter M-406. Below the second row of meters are two small panels. The left hand panel mounts three indicator lights and three toggle type switches. The indicator lights are, from left to right, STARTING SOLENOID indicator light I-403 (red), BIAS VOLTAGE indicator light I-402 (green) and PLATE VOLTAGE indicator light I-401 (red). Below the indicator lights, and in the same order, are MANUAL-AUTOMATIC GAIN switch S-402, TALK switch S-404 and CARRIER CONTROL switch S-403. In the upper row of the right hand panel are the SPEECH GAIN attenuator R-401 and the RECEIVER VOLUME attenuator R-429. Below these two controls on the same panel are the AUTOMATIC SHUTDOWN switch S-411 and the VOICE RELAY SENSITIVITY attenuator R-413. The AUTOMATIC SHUTDOWN switch S-411 is a feature which is included in the CAY-50065-B modulator for use only when this modulator is employed with a shore equipment. This switch has no function in shipboard equipments. The combination handset HS-401 is located adjacent to the tube access door. Beneath the handset is the CW-MCW-VOICE switch S-405 to the right of which is the FILAMENT VOLTAGE rheostat R-415. Tubes, and certain apparatus associated with them, are mounted on the tube shelf which is located behind the tube access door. Most of the remaining audio components are mounted on one of two floors, the lower one of which contains the modulator output coupling circuit. At the bottom of the set is located the terminal board and the terminal access door opens in front of this. Also, located behind this door, are the filament circuit fuses and lines for remote speech input operation.

c. ELECTRICAL.

(1) The electrical operation of the modulator may best be understood by referring to the schematic diagram Fig. 20, Dwg. T-7614584, and wiring diagram Fig. 22, W-7300869. Starting at the upper right corner of the schematic diagram, the audio input of the modulator is obtained from any one of three sources of speech input. These three sources of speech are as follows:

(a) The local handset S-401.

(b) Master Monitor Unit Navy Type CW-23071 or CW-23072.

(c) Radiophone Unit Navy Type CRV-23172 or CRV-23211.

(2) In the case of the last two types of speech input units, the audio output of the remote unit is fed into the 600 ohms line marked 1 and 2 on the schematic diagram. When either of the master monitor units is used, link switch S-410 is removed in order to derive the remote microphone supply from the master monitor unit. This power is supplied at 12 volts D.C. A similar power supply is available in the modulator for use with the local microphone. Other terminals are provided so that remote control may be had from the master monitor unit. For interconnection diagrams of Navy Type CW-23071 and CW-23072 units, see Figs. 24 and 25, Dwgs. M-7417689 and M-7417690 respectively.

(3) Terminals are also provided so that, in case the radiophone units are used, remote control may be had for them. In this case the 12 volt supply in the modulator is used for both local and remote microphones.

(4) When audio input is obtained from a 600 ohm line, it is applied (with the local handset on the hook) through S-401 and SPEECH GAIN attenuator R-401 to the input terminals of transformer T-402. When the handset HS-401 is removed from the hook, the audio input line is opened and it is possible to modulate only by means of HS-401 and through terminals 1 and 2. Transformer T-402 in turn excites the grids of the two amplifier tubes VT-401 and VT-402. The amplification continues through successive stages, consisting of transformers T-403, T-404 and T-405 and vacuum tubes VT-403, VT-404, VT-405 and VT-406. Full output of the modulator is applied through transformer T-405, capacitor C-408 and choke L-404 to terminal 32.

(5) Meters M-401, M-402, M-403 and M-404 are plate meters for the various stages, as can be seen from the diagram. Meter M-406 indicates FILAMENT VOLTAGE and meter M-405 PERCENT MODULATION. The amplifier will function either as a straight through amplifier or as a compressor-limiter amplifier. In the former case, the output voltage across modulation choke L-404 is proportional to input voltage across transformer T-402; in the latter case it is not. The choice of these modes of operations is made by means of switch S-402. Compressor-limiter action is afforded by means of vacuum tube VT-409 in conjunction with a winding on transformer T-404. Operation of this feature is such as to compress the higher values of input voltage. The smaller the input voltage the greater is the overall gain of the amplifier. Vacuum tube VT-409 also acts as limiter. Voltage applied to the input circuit in excess of that required for 100% modulation is prevented from damaging the equipment.

(6) The three modes of operation, CW, MCW and VOICE, are selected by means of switch S-405. In the CW position, this switch short-circuits choke L-404, meter M-405, choke L-405 and resistor R-415; it also opens the filament supply line to all tubes in the modulator unit and removes plate voltage from tubes VT-401, VT-402, VT-405 and VT-406. In the MCW position, switch S-405 closes the plate circuit to tubes VT-405 and VT-406 to make them operative. The switch also provides filament power in the MCW position, closes the tone oscillator circuit and removes the short-circuit across choke L-404. It also inserts resistor R-416 into the plate circuit of the transmitter power amplifier to reduce the voltage to a suitable value for modulation. In the VOICE position, the functions of switch S-405 are the same as in the MCW position, except that the plate circuit of tubes VT-401 and VT-402 is closed, the tone oscillator circuit opened and the short-circuit across meter M-405 is removed. Other contacts on this switch operate in conjunction with the radiophone units as described in Section IV.

(7) It is posible by means of the vacuum tube relay, consisting of tube VT-408 in conjunction with relay K-401, to operate the radio transmitter simply by talking into a remote microphone. This feature is optional and may be selected by switch S-403. In the MANUAL position of this switch it is possible to control the transmitter carrier by means of the "Press-to-Talk" button on the local microphone.

(8) S-404 is a triple throw TALK switch which has an OFF position in the center. This switch has two operating positions, the upper one of which is a locking position and the lower a non-locking position. In the lower position the switch is used as a key, whereby the transmitter can be keyed locally from the front of the modulator. In the upper position the switch performs the same function as a locked key.

(9) All plate voltages are obtained from the Type CAY-21676 motor-generator. Plate voltage for all tubes except the VT-405 and VT-406 is obtained from the bias or exciter generator which has a normal output voltage of 275 volts. Suitable operation voltages for plate, grid and screen of tubes VT-401, VT-402, VT-403, VT-404, VT-408 and VT-409 are obtained from a bleeder composed of resistors R-414, R-419, R-420 and R-421. Note that the exciter voltage (275 volts) is grounded on the positive side.

(10) Tubes VT-405 and VT-406 obtain their plate voltage from the 2000 volt armature of the high voltage generator. Filament power for all tubes, and power for the Rectox RX-401 which supplies 12 volts D.C. for microphone purposes, is obtained from transformer T-408.

(11) Modulation is applied to the radio transmitter power amplifier 3000 volt plate lead which enters the modulator on terminal 22. In either MCW or VOICE operation, resistor R-416 is inserted to reduce the plate voltage on the power amplifier tube to 2700 volts. Also, choke L-404, meter M-405 and transformer T-406 are inserted in the lead before it leaves the modulator on terminal 32. Additionally, screen modulation is applied to the power amplifier tube through capacitor C-420 and choke L-405.

(12) Screen and suppressor power for the Type —803 tubes VT-405 and VT-406 is obtained from a potentiometer located in the transmitter. Protective spark gaps are provided across transformer T-405 and reactor L-404. In addition, a limiter tube VT-407 and peak limiting resistors R-437 and R-438 are provided to prevent surges from damaging the output circuit. These components function in such a manner that surges are limited to a value very slightly exceeding 100 per cent modulation.

(13) MCW operation is provided by an 800 cycle oscillator comprised of tubes VT-403 and VT-404, reactor L-403 and capacitor C-405. In the MCW position of switch S-405, the oscillator circuit is closed through contacts of S-405 and the KEYING RELAY. In MCW operation both the modulator and the carrier are thus keyed.

7. POWER EQUIPMENT.

a. MOTOR-GENERATOR.

(1) The Navy Type CAY-21676 Motor-Generator supplied with the Navy Model TBM-12 Radio Telegraph and Telephone Equipment consists of a 230 volt D.C. driving motor, a high voltage generator and a low voltage generator. These units are rated as follows:

(a) Type CAY-21681 driving motor rated at 5 horsepower and 1800 r.p.m. and supplying 535 watts A.C. from the slip rings.

(b) Type CAY-21680 main plate generator rated at 3000 volts—0.035 amps. D. C. and 2000 volts—0.75 amps. D.C.

(c) Type CAY-21679 M.O. plate and bias generator rated at 1000 volts—0.075 amps. D.C. and 275 volts—1.3 amps. D.C.

(2) The motor-generator supplied as a part of the TBM-12 equipment is of rugged design. This set has ample capacity for operation of the transmitter alone or in conjunction with a Navy Type CAY-50065-B modulator unit.

(3) The motor and generators are semi-enclosed, constant speed, continuous duty, self ventilating and drip proof from all angles within the limits of 45 degrees on either side of the vertical and included in any plane perpendicular to the axis. The units are rated on a basis of a 40 degree C. temperature rise in an ambient temperature of 50 degrees C.

(4) The various units of the motor-generator set are fitted with ball-bearings and are flexibly coupled together and mounted on a cast steel bedplate. They are so designed and constructed that the entire motor-generator may be moved about or supported at its extreme ends while running without disturbing the alignment of the units. Any unit may be removed without necessitating the removal of any other unit from the bedplate.

(5) The D.C. generators are excited from the bias generator. Fuses are installed on the terminal boards of all generators to protect them from damage due to the failure of any part of the equipment.

(6) The double commutator 2000 and 3000 volt D.C. plate power generator Type 21680 is compound wound and separately excited from the 275 volt D.C. bias generator Type CAY-21679. This main plate generator is rated at 2.31 kw. for 40 degrees C. temperature rise and will deliver .75 amperes at 2000 volts and .35 amperes at 3000 volts. This unit consists of a single core armature with a commutator mounted on each end. There are two main poles and two commutating poles. There are two output windings in the armature slots. A 2000 volt winding connects to the commutator on the motor end of the machine, and a 1000 volt winding connects to the commutator on the blower end of the machine. The output from these two circuits is connected in series so that there is available from the unit both 2000 and 3000 volt outputs. All terminals and fuses are mounted on ceramic insulators. This unit is used to supply plate and grid power to the intermediate amplifiers, power amplifier and to the modulator unit when used. See Figs. 44 and 45, Dwg. CAY-T-155, sheets 11 and 12.

(7) The 275 and 1000 volt D.C. master oscillator plate and bias generator Navy Type CAY-21679 is compound wound. Its shunt field is excited from the 275 volt winding, and the compound winding is connected in series with the 1000 volt winding. The 1000 volt winding is connected to the commutator at the shaft projection end of the machine. The generator is rated at .43 kw. continuous load for 40 degrees C. temperature rise and will deliver 1.3 ampere at 275 volts D.C. and .075 ampere at 1000 volts D.C. The unit has a two-pole field and double commutator two winding armature as shown on Figs. 46 and 47, CAY-T-155, sheets 13 and 14, Dwgs. 33-J-175 and 33-J-176. The generator is used to supply 275 volts for amplifier tube bias and generator excitation; and plate, screen and bias voltages for the first two audio stages in the modulator unit, when used. The 1000 volt winding is used to supply plate and screen grid power for the master oscillator tube. The terminals and fuse of the 1000 volt circuit are mounted on ceramic insulators. A porcelain fuse block is used for the 275 volt circuit.

(8) The 230 volt D.C. motor Type CAY-21681 is of the shunt wound type and is rated at 5 H.P., 1800 r.p.m. The motor is provided with four main poles and two commutating poles. A pair of slip rings are mounted on the armature shaft opposite the commutator. The armature winding is tapped at two points and connected to the slip ring. A.C. power output of 535 watts, 160 volts, 60 cycles, single phase is available from the slip rings for filament heating.

b. MAGNETIC CONTROLLER.

(1) The Navy Type CAY-211232, 230 volt D.C. magnetic controller is rated at 5 horsepower and is of the class A, remote controlled, drip proof, protected magnetic contactor type. All of the contactors, relays and resistors, associated with the controller, are assembled on an insulated panel and mounted in a sheet steel box.

(2) The complete controller consists of a line switch, a line contactor, a thermal overload relay, two time delay accelerating contactors, one control circuit fuse, one control circuit resistor and one starting resistor all mounted on an insulated panel. See Figs. 18 and 50.

SECTION III

INSTALLATION

8. GENERAL.

a. The installation force should become generally familiar with the Description, Installation and Operation Sections of this book before proceeding with the actual installation of the TBM-12 Transmitting Equipment. When installing the various units of the equipment, reference should be made to the interconnection diagrams in Section VIII of this book which show the interconnection wiring, recommended wire sizes and types and interconnecting directions. In the unpacking and handling of the units, during the process of installation, care should be exercised to prevent damage to equipment. The following precautions should be observed:

(1) Keep boxes and crates containing equipment in the upright position at all times. The upright position is indicated by an arrow pointing upward, stenciled on each box or crate.

(2) Observe weights marked on boxes, crates and units, as the large units weigh from 1000 to 1500 pounds, when packed. Adequate transporting and lifting gear and sufficient handling personnel should be available to prevent equipment from being subjected to unwarranted shock.

(3) Remove at least three sides from boxes or crates by removing nails with a nail puller; do not use a hammer or pinch bar for this purpose.

b. The various units should be carefully uncrated, and all wrappings removed. The shields should be removed and each compartment given a thorough inspection to determine any damage caused by shipment.

c. The typical test data and Instruction Book are secured inside the front cover of the Radio Transmitter Unit packing box after acceptance by the Inspector. They should be removed and the typical test data placed in the Instruction Book for use during installation.

d. Any components or wiring, which may have been displaced during shipment should be replaced in their proper locations. The shock absorbers on the tube shelves should be inspected to see that they permit normal motion, and are not cracked or unduly distorted. Reference should be made to the interconnection diagram Fig. 23, Dwg. T-7614583. Complete instructions for the proper connections of motors, transformers and link switches are contained in this diagram.

e. After completing the installation of the equipment, according to the installation instructions for the various units, and before connecting the supply line, carefully check all interconnection wiring performed by the installation force. This check should be performed by circuit check test practices to insure that all circuits are complete according to the interconnection diagram.

f. After checking all interconnection wiring as to proper connection, wire size and insulation, the preliminary checks on the various units may be carried out.

9. TRANSMITTER INSTALLATION.

a. The transmitter unit should be installed in a position that allows access to all four sides of the transmitter frame. Provide sufficient clearance, preferably not less than 18 inches, on the left or master oscillator side of the unit. This is essential so that the master oscillator unit may be removed from the transmitter frame without unbolting the transmitter from its foundation. Before the transmitter is secured to its foundation, all wood blocking must be removed from around the master oscillator. The hold-down bolt should be completely removed from the bottom of the unit so that the master oscillator frame hangs free on its supporting springs. After this is done, the shields should be replaced and the transmitter securely fastened to its foundation by means of one-half inch studs or bolts, through holes provided in the mounting channels. For mounting dimensions see outline drawing Fig. 26, Dwg. T-7611719. The antenna lead should be made of $\frac{3}{8}$ or $\frac{1}{2}$ inch O.D. copper tubing and should be kept at least six inches away from any grounded objects.

b. The frames of the transmitter unit, the motor-generator unit, the modulator unit and the magnetic controller should be electrically tied together and grounded by a copper strap at least one inch wide and 1/32 inch thick, making sure that a metal-to-metal connection is made at each point of contact.

10. RATING AND RANGE.

a. The transmitter unit is suitable for use with any antenna whose characteristics fall within the limits set forth in paragraph 5*a*(1). This paragraph describes the sizes and lengths of suitable antennas.

Under these conditions the transmitter unit will deliver the power given in the following table, using a Type —861 tube in the final amplifier.

FREQUENCY (KCS.)	OUTPUT WATTS
2000 to 3035	500
3035 to 4105	475
4105 to 6000	450
6000 to 7500	400
7500 to 9050	375
9050 to 12000	360
12000 to 16000	325
16000 to 18100	300

A 500 watt, 110 Volt Mazda "C" Lamp, practically non-reactive resistance betwen antenna terminal and ground, may be used to check power output at all frequencies.

c. The maximum power necessary for starting the equipment is 10 kw. while the allowable voltage variation is ± 10%. The power necessary from the supply line for locked key operation is 4.3 kw. (Power required for starting measured by a critically damped instrument.)

11. MODULATOR INSTALLATION.

a. The modulator should be installed so that all sides are accessible for inspection of the equipment and the possible replacement of parts in case of trouble. The modulator should be securely fastened to its foundation by means of one-half inch studs or bolts through holes provided in the mounting channels of the equipment. See outline drawing Fig. 27, Dwg. P-7714933, for the mounting dimensions of the unit. The location of these holes should be such that, when the modulator is finally fastened down it will not be more than three feet from the transmitter with which it operates, and preferably a shorter distance.

b. Refer to modulator unit wiring diagram Fig. 22, Dwg. W-7300869, and remove link switch S-410 if Type CW-23071 or CW-23072 monitor units are used. Change the positions of link switches S-408 and S-409 if the receiver attenuator relay uses the 115 volt D.C. coil supply. Refer to the interconnection diagrams and note that the lead from terminal 32 on the modulator unit to the terminal of the same number on the transmitter should be kept as short as possible, and less than five feet at most.

c. If more than one radiophone unit is used with an equipment certain connections are made through a distribution panel and some through the modulator unit. Fig. 23, Dwg. T-7614583, shows the method of connecting one radiophone unit with the equipment. For more than one radiophone unit refer to the Instruction Book on the radiophone units. Figs. 24 and 25, Dwgs. M-7417689 and M-7417690, illustrate the manner of making connections to the master monitor units Types CW-23071 and CW-23072.

d. The modulator should be tied electrically to the same grounding system as the transmitter frame and the motor-generator frame by a copper strap at least one inch wide and 1/32 inch thick, making certain that a metal-to-metal connection is made at each point of contact.

e. The maximum power line requirement for full power, locked key operation, one hundred per cent modulation is 5.7 kw. The voltage variations permitted will be plus or minus ten per cent.

12. MOTOR-GENERATOR AND MAGNETIC CONTROLLER INSTALLATION.

a. The motor-generator used with the TBM-12 equipment should be securely bolted to the floor in a place as free as practical from dust and moisture. Overall and mounting dimensions for the Type CAY-21676 motor-generator may be found on Fig. 28, Dwg. T-7611738.

b. The magnetic controller is designed to be mounted on a wall and should be securely bolted in place conveniently near the motor-generator unit. Fig. 29, Dwg. P-7713319, shows the overall and mounting dimensions of the Type CAY-211232 magnetic controller. The overload relay should be adjusted to operate at a current of 32 amperes for 230 volt D.C. operation.

WARNING

Operation of this equipment involves the use of high voltages which are dangerous to life. Operating personnel must at all times observe all safety regulations. See page ix. Do not change tubes or make adjustments inside the equipment with the high voltage supply on. Do not depend on door switches and interlocks for protection but always shut down the motor-generator or other power equipment and open the main switch in the supply line to the equipment.

13. PRELIMINARY CHECKS TRANSMITTER.

a. All link switches must be in their proper position before applying power to the equipment. Make sure that the proper resistors are in their correct place according to the schematic diagram. For four or six wire control, make connections as shown on the interconnection diagram.

b. Refer to Figs. 1 and 2, showing the locations of the controls, and with no tubes in the transmitter, place the controls in the following positions:

(1) Turn the filament rheostat R-6 and the field rheostat R-33 counterclockwise to maximum resistance position.

(2) HIGH-LOW POWER switch S-3 to the HIGH position.

(3) LOCAL-REMOTE switch S-7 to LOCAL.

(4) TUNE-OPERATE switch S-9 to TUNING STEP 1.

(5) TEST key S-10 to neutral (center position).

(6) START-STOP switch S-8, S-17 to STOP.

(7) EMERGENCY SWITCH S-12 to ON.

(8) EMISSION switch S-405 on the modulator unit to CW. See paragraph 6*c*(6).

(9) Close all doors to the transmitter, modulator and controller.

(10) Push in OVERLOAD RELAY RESET button.

c. Power is supplied to the transmitter used with the TBM-12 equipment, whenever power is supplied to the line terminals of the magnetic controller. This power is used for the master oscillator heater system and the transmitter unit control circuits. This power is always available at the transmitter unit regardless of whether or not the motor-generator is operating.

d. As soon as power is applied to the transmitter unit the following operations should take place in the transmitter:

(1) The blower motor B-1 should run.

(2) The HEATER CIRCUIT indicator light I-5 (amber) should light.

e. Apply filament and M.O. plate power (1000 volts) by placing the START-STOP switch S-8, S-17 to START. The following operations should take place:

(1) Starting contactor K-4 should close.

(2) STARTING SOLENOID indicator lamp I-2 (red) should light.

(3) Motor-generator should start and come up to normal speed in approximately 5 to 10 seconds.

(4) FILAMENT VOLTAGE voltmeter M-11 in the transmitter should indicate approximately 12 volts.

(5) M.O. FILAMENT indicator lamp I-4 (clear) should light.

(6) Field contactor K-9 should close.

(7) BIAS VOLTAGE indicator lamp I-1 (green) should light and BIAS VOLTAGE voltmeter M-12 should indicate approximately 275 volts.

(8) PLATE VOLTAGE voltmeter M-9 will not indicate but plate voltage (1000 volts) will be applied to the master oscillator plate and screen grid terminals.

(9) PLATE VOLTAGE indicator lamp I-3 (red) should light.

f. Test out the door interlocks by opening one door at a time. The motor-generator and transmitter should shut down (except master oscillator heater and blower motor in the transmitter unit) when any access door is open, and start again when the access door is closed.

g. Place EMERGENCY SWITCH S-12 on the transmitter unit to STOP. The motor-generator unit should shut down. On 4-wire control systems, the motor-generator unit should start when EMERGENCY SWITCH S-12 on the transmitter is placed in the ON position. On 6-wire control systems it will be necessary, after closing the EMERGENCY SWITCH, to close START-STOP switch S-17A before the motor-generator will start.

h. Apply reduced plate voltage (1000 volts approx.) on the intermediate and power amplifiers by placing TUNE-OPERATE switch S-9 to TUNING STEP 2. PLATE VOLTAGE voltmeter M-9 on the transmitter should indicate voltage of the 2000 volt armature, which should be about 1000 volts because field rheostat R-33 is in the minimum voltage position.

i. Apply increased plate voltage (1500 volts) on intermediate and power amplifiers by placing TUNE-OPERATE switch S-9 on the transmitter to the OPERATE position. PLATE VOLTAGE voltmeter M-9 on the transmitter should indicate the voltage of the 3000 volt terminal, which is about 1500 volts, as the field rheostat is still in minimum voltage position.

j. Operate TEST key S-10 on the transmitter.

(1) KEYING RELAY K-1 should operate.

(2) Compensator relay K-2 should close.

k. Shut down the motor-generator and transmitter by placing the START-STOP switch S-8, S-17 on transmitter unit to STOP.

l. Return TUNE-OPERATE switch S-9 on the transmitter to TUNING STEP 1.

m. Leave LOCAL-REMOTE switch S-7 in the LOCAL position.

n. Place Type —860 tubes in the tube sockets of the master oscillator unit, first and second intermediate amplifiers, and a Type —861 tube in the tube mounting of power amplifier. Make all tube connections, being certain to connect the auxiliary screen grid terminal for the power amplifier tube. This connection is located to the rear of the Type —861 power amplifier tube.

o. Apply filament and M.O. plate voltage (1000 volts) to the equipment by placing START-STOP switch S-8, S-17 on the transmitter to START. Adjust the FILAMENT VOLTAGE of the transmitter vacuum tubes to 10 volts as indicated by FILAMENT VOLTAGE voltmeter M-11 and controlled by FILAMENT VOLTAGE rheostat R-6. The FILAMENT VOLTAGE voltmeter M-11 is connected across the filaments of the first and second intermediate amplifier Type —860 tubes, instead of across the filaments of the Type —861 tube. The reason being that in the LOW POWER position, the Type —861 tube is not used as the power amplifier and is, therefore, disconnected. When the filament voltage voltmeter M-11 indicates 10 volts, the correct potential is applied to all tubes; 10 volts to the Type —860 and 11 volts to Type —861. Shut down the motor-generator and transmitter units by placing START-STOP switch S-8, S-17 to STOP.

p. In conducting the following preliminary installation tests, have at hand one copy of typical test data, or type test data, that is packed inside the transmitter after inspection by the Navy Inspector. This test data contains the exact dial and control settings for various frequencies between 2000 and 18100 kcs. on the transmitter unit during Navy Acceptance Test at the manufacturer's plant. Although in service the frequencies desired will not be the same as those shown on test data, the approximate dial and control settings can be obtained by interpolation. By carefully following this test data, it will be possible to select the correct harmonic of each tuned circuit and avoid the possibility of tuning to a harmonic of a previous stage when the fundamental was desired or vice versa. Approximate calibration curves are given on Figs. 30, 31, 33 and 32, Curves Nos. 226373, 218634, 218635 and 218636, respectively. A table of Typical dial and Tap Settings and a table of Typical Meter Readings are given on Figs. 35 and 34. For a preliminary test, the following settings will be approximately correct for a frequency of 2000 kcs. The various controls are identified by letters as marked on the front panel, followed by the circuit symbol designation used on the schematic diagram.

q. Close all access doors of the equipment.

r. Set the transmitter unit controls as follows:

(1) Set START-STOP switch S-8, S-17 to STOP.

(2) Set LOCAL-REMOTE switch S-7 to LOCAL.

(3) Set TUNE-OPERATE switch S-9 to TUNING STEP 1.

(4) Set EMERGENCY SWITCH S-12 to ON.

(5) Set the MASTER OSCILLATOR RANGE switch (control A) S-1 on tap 1.

(6) Set MASTER OSCILLATOR TUNING (control B) L-1 to 1872 divisions.

(7) Set DOUBLER CIRCUIT TUNING (control C) C-14 to 18 divisions.

(8) Set FIRST INTERMEDIATE AMPLIFIER TUNING (control D) C-21 to 26 divisions.

(9) Set SECOND INTERMEDIATE AMPLIFIER TUNING (control E) L-9 to 53 divisions.

(10) Set POWER AMPLIFIER TUNING (control F) L-14 to 59 divisions.

(11) Set FREQUENCY RANGE SWITCH (control L) S-2 for the 2000 to 4000 kilocycle range.

(12) Set ANTENNA COUPLING (control H) C-41 to 1500 divisions.

s. Start up the motor-generator and transmitter, applying M.O. plate voltage of 1000 volts, by placing START-STOP switch S-8, S-17 to START. Perform the following adjustments on the transmitter unit.

(1) Check FILAMENT VOLTAGE voltmeter M-11 and adjust, if necessary, to 10 volts by means of FILAMENT VOLTAGE rheostat R-6.

(2) Operate TEST key S-10. The M.O. PLATE CURRENT meter M-7 and M.O. SCREEN GRID CURRENT meter M-8 should indicate current of about 60 and 11 ma. respectively.

(3) Set TUNE-OPERATE SWITCH S-9 and adjust GENERATOR FIELD rheostat R-33 until PLATE VOLTAGE voltmeter M-9 indicates 2000 volts.

(4) Operate TEST key S-10 and adjust DOUBLER CIRCUIT TUNING (control C) C-14 for maximum indication on 1ST INT. AMP. PLATE CURRENT meter M-6. (Approximately 60 ma.)

(5) Adjust 1ST INTERMEDIATE AMPLIFIER TUNING (control D) C-21 for minimum indication on 1ST INT. AMP. PLATE CURRENT meter M-6 or maximum indication on 2ND INT. AMP. GRID CURRENT meter M-5. (Approximately 25 ma. on M-6 or 25 ma. on M-5.)

(6) Adjust 2ND INTERMEDIATE AMPLIFIER TUNING (control E) L-9 for minimum indication on 2ND INT. AMP. PLATE CURRENT meter M-4 or for maximum indication on P. A. GRID CURRENT meter M-3. (Approximately 50 ma. on M-4 or 60 ma. on M-3.)

(7) Adjust POWER AMPLIFIER TUNING (control F) L-14 for minimum indication on P. A. PLATE CURRENT meter M-2.

(8) If antenna is under 50 feet long, or over 80 feet long, set ANTENNA FEED switch S-6 to CURRENT feed. If betwen 50 and 80 feet in length, set the ANTENNA FEED switch S-6 to VOLTAGE feed. (These dimensions are only approximate.)

(9) If ANTENNA FEED switch S-6 is in CURRENT feed position, set the ANTENNA TUNING INDUCTANCE (control K) L-13 to 0 and adjust the ANTENNA TUNING CAPACITOR (control J) C-42 for maximum output as indicated on the ANTENNA CURRENT meter M-1.

(10) If ANTENNA FEED switch S-6 is in VOLTAGE feed position, set ANTENNA TUNING INDUCTANCE (control K) L-13 to 1000 divisions and adjust ANTENNA TUNING CAPACITOR (control J) C-42 for maximum indication on P. A. PLATE CURRENT meter M-2.

(11) If P. A. PLATE CURRENT meter M-2 indicates over 150 milliamperes, reduce ANTENNA COUPLING (control H) C-41.

(12) Set TUNE-OPERATE switch S-9 to OPERATE and adjust GENERATOR FIELD rheostat R-33 until PLATE VOLTAGE voltmeter M-9 indicates 3000 volts. Close TEST key S-10 and readjust ANTENNA TUNING CAPACITOR (control J) C-42 for maximum output on ANTENNA CURRENT meter M-1. At the same time adjust ANTENNA COUPLING (control H) C-41, if necessary, to keep the P. A. PLATE CURRENT meter M-2 to a value *not in excess* of 350 milliamperes. It may be necessary to readjust slightly the POWER AMPLIFIER TUNING (control F) L-14 for minimum value on P. A. PLATE CURRENT meter

M-2 due to antenna effects. Optimum efficiency of operation is the condition giving maximum indication on the ANTENNA CURRENT meter M-1 with the minimum indication on the P. A. PLATE CURRENT M-2. Refer to Fig. 34, or the test data which accompanies the equipment, for typical meter readings with the TUNE-OPERATE switch on OPERATE.

Note

In order to resonate the antenna, it may be necessary to try various combinations of ANTENNA TUNING INDUCTANCE (control K) L-13 and ANTENNA TUNING CAPACITOR (control J) C-42, also VOLTAGE or CURRENT FEED to the antenna to obtain maximum output without the power amplifier being overloaded.

t. When operating the transmitter on lower power, with the HIGH-LOW POWER switch S-4, S-5 in LOW position, the unit should be tuned as described. However, the following exceptions apply: The POWER AMPLIFIER TUNING (control F) L-14 and the P. A. GRID CURRENT meter M-3 are omitted. The ANTENNA COUPLING (control H) C-41 is so adjusted that the second intermediate amplifier (now used as a final amplifier), 2ND INT. AMP. PLATE CURRENT meter M-4 *does not exceed* 150 milliamperes. It is to be recalled that the upper limiting frequency is 9050 kcs. in the LOW POWER position.

u. The PLATE VOLTAGE voltmeter M-9 should not exceed 3000 volts regardless of the position of the HIGH-LOW POWER switch. This can be adjusted by GENERATOR FIELD rheostat R-33 on the transmitter unit. The 2000 volt circuit of the main generator is used to supply plate and screen grid voltage (2100 volts maximum) to the Type —860 tubes in the first and second intermediate amplifier stages. This voltage is indicated on PLATE VOLTAGE voltmeter M-9 on the transmitter when the TUNE-OPERATE switch S-9 is on TUNING STEP 2. The PLATE VOLTAGE voltmeter M-9 on the transmitter always indicates the voltage which would be applied to the plate of the Type —861 tube if the HIGH-LOW POWER switch S-5 were on HIGH POWER.

v. When adjusted to the frequency of 2000 kcs. normal output, record setting of all frequency determining controls. Shut down the equipment by placing START-STOP switch S-8, S-17 to STOP.

14. PRELIMINARY CHECKS, MODULATOR.

a. With no tubes in the unit, place the modulator controls in the following positions:

(1) Turn the FILAMENT VOLTAGE rheostat R-415 to the maximum resistance position which is also the maximum counterclockwise position.

(2) CW-MCW-VOICE switch S-405 to CW position.

(3) SPEECH GAIN attenuator R-401, VOICE RELAY SENSITIVITY attenuator R-413 and RECEIVER VOLUME attenuator R-429 to zero position.

(4) MANUAL-AUTOMATIC GAIN switch S-402 to MANUAL position.

(5) TALK switch S-404 to OFF position.

(6) CARRIER CONTROL switch S-403 to MANUAL position.

(7) HANDSET HS-401 on hook.

(8) AUTOMATIC SHUTDOWN switch S-411 to remain in position 2 at all times.

b. Adjust links on transformers T-408 and T-409 for the proper power supply per wiring diagram Fig. 22, Dwg. W-7300869.

c. Insert fuses F-401 and F-402 in the fuse block just inside the terminal board access door. Close all modulator access doors and replace all shields.

d. Filament power is supplied to the modulator through terminals 38 and 39 on the transmitter unit. These terminals bear the same numbers on the modulator's unit. From the transmitter the same terminals run to the slip rings on the motor-generator set driving motor. Therefore, filament power is available at the modulator only when the motor-generator set is running. However, the filaments do not light when switch S-405 is in the CW position. When the motor-generator is started, indicator light I-403 (red) will indicate, regardless of the position of switch S-405. Also, after the motor-generator set is running, indicator light I-402 (green) will indicate, showing that bias voltage and plate voltage for the lower power stages is also available. Switch S-405 should be turned to the three positions CW-MCW-VOICE in order to check the above operation.

e. When plate power is applied indicator light I-401 (red) will light. Test out the door interlocks by opening and closing one door at a time. The motor-generator should shut down whenever any door is opened.

f. Insert a complete set of vacuum tubes in their corresponding tube sockets as follows:

(1) VT-401 insert Type —6D6.

(2) VT-402 insert Type —6D6.

(3) VT-403 insert Type —807.

(4) VT-404 insert Type —807.

(5) VT-405 insert Type —803.

(6) VT-406 insert Type —803.

(7) VT-407 insert Type —1616.

(8) VT-408 insert Type —807.

(9) VT-409 insert Type —25Z5.

g. It will now be possible to adjust modulator filament voltage after starting the motor-generator. Overload relay K-5 should be opened to prevent application of plate voltage until modulator filament is adjusted to the proper value. Gradually turn FILAMENT VOLTAGE rheostat R-415 clockwise until meter M-406 indicates exactly 10 volts.

h. With the filaments properly lighted, reset overload relay K-5 in the transmitter. This supplies plate voltage (approximately 2000 volts) to the modulator tube. Meter readings, taken with switch S-405 in the VOICE position, should then be approximately as follows:

(1) INPUT AMPL. PLATE CURRENT meter M-401 should read 3 ma.

(2) INT. AMPL. PLATE CURRENT meter M-402 should read 120 ma.

(3) MODULATION PLATE CURRENT meter M-403 should read 50 ma.

(4) MODULATION PLATE CURRENT meter M-404 should read 50 ma.

(5) FILAMENT VOLTAGE meter M-406 should read 10 volts plus or minus two per cent.

i. Turn MANUAL-AUTOMATIC GAIN switch S-402 to AUTOMATIC. Reading of INPUT AMPL. PLATE CURRENT meter M-401 should change to about 5 ma. Return MANUAL-AUTOMATIC GAIN switch to MANUAL and shut down the motor-generator unit.

15. PRELIMINARY CHECKS, POWER EQUIPMENT.

a. After completing the installation of the motor-generator and magnetic controller units, carefully check all installation wiring. This check should be performed by approved circuit check practices to see that all circuits are complete.

b. Tests on the power equipment should be performed in conjunction with the tests on the transmitter unit, since the starting and stopping of the motor-generator unit is controlled by circuits in the transmitter. Refer to paragraphs 13*a* through 13*v*.

SECTION IV

OPERATION

WARNING

Operation of this equipment involves the use of high voltages which are dangerous to human life. Operating personnel must at all times observe all safety regulations. See page ix. Do not change tubes or make adjustments inside the equipment with the high voltage supply on. Do not depend on door switches or interlocks but always open line switches before servicing the equipment. Always discharge the filter capacitors as they may be retaining dangerous charges even though the power is not on the set. Bleeder resistors and other circuits have been providd across these capacitors but the additional precaution of grounding them should be observed in case they are not completely discharged.

16. OVERLOAD PROTECTION.

a. The following overload protection is provided in the transmitter unit.

b. The coils of H.V. overload relay K-5 and M.O. plate overload relay K-7 are located in the transmitter main plate and master oscillator plate circuit respectively. Relay K-5 and relay K-7 operate on overload to shut down the motor-generator and the transmitter by dropping out main starting contactor K-4 and field contactor K-9. These relays are manually reset from the front of the transmitter panel.

c. On the Type CAY-52218 transmitter unit heater circuit fuse F-1 (6 amp., 250 volt) located on the transmitter terminal board, protects the master oscillator temperature system including heater resistor R-26 and D.C. blower motor B-1. Control circuit fuse F-2 (6 amp., 250 volt), located on the transmitter terminal board, protects the D.C. control circuits.

d. Overload protection is provided for the modulator tubes VT-405 and VT-406 by means of overload relay K-5 located in the transmitter. When a modulator is employed, this relay should be adjusted to allow approximately 250 ma. additional plate current in the 3000 volt generator lead.

e. Fuses mounted on the generator terminal boards protect the generator high voltage windings from faults in the high voltage cable betwen the generators and the transmitter unit. See paragraphs 7*c*(6) and 7*c*(7).

f. Control fuses in the controller units protect the controller control circuits. See paragraph 7*b*(2).

g. In the controller, a thermal overload protective device protects the motor against overload. This relay K-854 is of the manual reset type.

h. Refer to Figs. 36 and 37 for pertinent information on protective relays.

17. TRANSMITTER UNIT OPERATIONS.

a. The transmitter unit may be started and stopped by means of START-STOP switch S-8, S-17 on the transmitter front panel. When LOCAL-REMOTE switch S-7 is placed in the REMOTE position, the transmitter may be started by pressing the remote starting switch on the 4- or 6-wire remote control unit. LOCAL control is always supervisory in that START-STOP switch S-8, S-17, on the transmitter, will stop the equipment even when the remote starting switch has been closed.

b. In order to obtain the best performance regarding frequency stability and accuracy of calibration, the master oscillator heat compartment, in which are located the frequency determining elements, should be up to a temperature of approximately 60° C. (140° F.) for normal operation. This will require approximately three hours after power has been applied. For this reason the master oscillator heater circuit should be left on at all times when operation of the transmitter is planned within three hours.

c. An indicating thermometer Th-1, Type CHB-40025, is provided, having its bulb in the constant temperature compartment and its scale on the front panel of the transmitter. Under normal ambient temperature conditions of approximately 25° C., thermometer Th-1 should indicate a temperature between 59° and 61° C. provided that heater circuit power has been on the transmitter for at least three hours. A slight fluctuation of the thermometer reading of approximately plus or minus .1° C. may be noted, and is due to the cycling of the temperature control apparatus. Since the thermometer bulb is not in intimate contact with the frequency determining circuit parts, and also because the thermometer is somewhat affected by the ambient temperature due to exposure of stem and scale, the thermometer reading is not generaly an exact indication of the temperature of the circuit parts. If, however, the thermometer reading is between 58.5° and 61.5° C., it may be assumed that the frequency determining circuit parts are at their normal temperature as controlled by thermostat S-13.

d. When LOCAL-REMOTE switch is placed in the LOCAL position, KEYING RELAY K-1 and associate parts K-2, R-17 and R-30 receive power from the bias supply in the transmitter, or from the D.C. input line, depending upon the position of link switches S-18, S-20 and S-21, and whether 4- or 6-wire control is used. For 6-wire control, or bias keying, a tap is taken from bias potentiometers R-19, R-21 and R-28 at such a point that 115 volts D.C. appears between this tap and ground when the key is closed and the transmitter is operated so as to give rated output. The actual circuit is from the bias potentiometer through KEYING RELAY series resistor R-30 to terminal 19 on the terminal board. From terminal 19, the circuit passes through the range switch interlocks S-2A, S-9B and S-1C to terminal 20. It next goes to relays K-1 and K-2 in parallel and then through TEST key S-10 to ground where it completes the circuit. The circuit is wired to terminals 19 and 20 on the terminal board to provide a means for circuit checking in case trouble arises in the keying circuit and, if necessary, to short circuit switch interlocks S-2A, S-9B and S-1C in case of an emergency.

e. It is possible, by means of S-20 and S-21 in the transmitter, to connect the keying relay circuits across a potentiometer consisting of R-36 and R-29 which is connected across the 230 V.D.C. supply line. See Fig. 19, Dwg. W-7300875.

f. After the motor-generator, magnetic controller, transmitter and modulator have been installed and preliminary tests completed, the calibration and further check of the equipment should be effected.

g. Close all access doors of the transmitter, magnetic controller and modulator units.

h. Set the transmitter unit controls as follows:

(1) Set START-STOP switch S-8, S-17 to STOP.

(2) Set LOCAL-REMOTE switch S-7 to LOCAL.

(3) Set TUNE-OPERATE switch S-9 to TUNING STEP 1.

(4) Set EMERGENCY SWITCH S-12 to ON.

(5) Refer to the Table of Typical Dial and Tap Settings Fig. 35 and the test data which accompanies this equipment and set tuning controls "A," "B," "C," "D," "E," "F," "G," "H," "J," "K," and "L" to the approximate frequency desired.

(6) The frequency standard that is to be used to calibrate this transmitter should be started and set to desired frequency. This frequency standard can be any type of heterodyne frequency meter used in the service that is capable of giving beats on the fundamental frequencies of 2000 to 4525 kcs. Due to the frequency stability of the transmitter, it is only necessary to set the master oscillator to the desired frequency by the frequency standard. Then, adjust the intermediate amplifiers, power amplifier and antenna tuning circuits to resonance. The audio output from the frequency standard is available at the FREQUENCY METER AUDIO OUTPUT jack, J-1, which will facilitate calibration.

(7) R.F. coupling terminals are provided on the transmitting unit for connection to the frequency standard. Approximately 15 millivolts of R.F. is available at these terminals, at the master oscillator output frequency, providing the DOUBLER CIRCUIT TUNING (control C) is tuned.

i. The R.F. voltage is provided by coupling capacitor C-68. This capacitor consists of an adjustable band around the grid terminal stand-off insulator of the first intermediate amplifier tube VT-2. The band provides capacity coupling to the grid lead of the first intermediate amplifier tube. By moving this band up and down the stand-off insulator, the amount of coupling R.F. pick-up voltage can be varied to suit individual installation conditions. By moving it closer to the top, or the grid terminal end of the insulator, the pick-up voltage is increased. If the band is moved away from the grid terminal end of the insulator, towards ground, the pick-up voltage is decreased. Normally, it is set approximately ½ inch from the grid terminal which gives sufficient pick-up for most installations. If adjustment of capacitor C-68 is found necessary, it should be locked securely in place after adjustment is made.

j. Apply 1000 volts plate voltage and filament power, starting the motor-generator by means of START-STOP switch S-8, S-17. Check FILAMENT VOLTAGE meter M-11 and adjust, if necessary, to 10 volts by means of FILAMENT VOLTAGE rheostat R-6. Set frequency controls "A" and "B" to the desired frequency.

k. Operate TEST key S-10. The M.O. PLATE CURRENT meter M-7 and M.O. SCREEN GRID CURRENT meter M-8 should indicate current of about 60 and 11 ma., respectively.

l. Set TUNE-OPERATE switch S-9 to TUNING STEP 2 and adjust field rheostat R-33 until PLATE VOLTAGE voltmeter M-9 reads 2000 volts. Operate TEST key S-10 and adjust DOUBLER CIRCUIT TUNING (control C) C-14 for maximum indication on 1ST INT. AMP. PLATE CURRENT meter M-6. (Approximately 68 ma.)

m. Adjust 1ST INTERMEDIATE AMPLIFIER TUNING (control D) C-21 for minimum indication on 1ST INT. AMP. PLATE CURRENT meter M-6 for maximum indication on 2ND INT. AMP. GRID CURRENT meter M-5. (Approximately 25 ma. on M-6 or 25 ma. on M-5.)

n. Adjust 2ND INTERMEDIATE AMPLIFIER TUNING (control E) L-9 for minimum indication on 2ND INT. AMP. PLATE CURRENT meter M-4 or for maximum indication on P. A. GRID CURRENT meter M-3. (Approximately 50 ma. on M-4 or 60 ma. on M-3.)

o. Adjust POWER AMPLIFIER TUNING (control F) L-14 for minimum indication on P.A. PLATE CURRENT meter M-2.

p. If the antenna is under 50 feet long or over 80 feet long, set ANTENNA FEED switch S-6 to CURRENT FEED. If betwen 50 and 80 feet in length, set ANTENNA FEED switch S-6 to VOLTAGE FEED. (The dimensions are only approximate.)

q. If ANTENNA FEED switch S-6 is in the CURRENT FEED position, set ANTENNA TUNING INDUCTANCE (control K) L-13 to 0 and adjust ANTENNA TUNING CAPACITOR (control J) C-42 for maximum output as indicated on ANTENNA CURRENT meter M-1.

r. If the P.A. PLATE CURRENT meter M-2 indicates over 150 milliamperes, reduce the ANTENNA COUPLING (control H) C-41 and retune the antenna system as in paragrauhs 17*p* and 17*q*.

s. Set TUNE-OPERATE switch S-9 to OPERATE and adjust GENERATOR FIELD rheostat R-33 until PLATE VOLTAGE meter M-9 indicates 3000 volts. Close TEST key S-10 and readjust ANTENNA TUNING CAPACITOR (control J) C-42 for maximum output as indicated on ANTENNA CURRENT meter M-1. At the same time adjust ANTENNA COUPLING (control H) C-41, if necessary, to keep the P.A. PLATE CURRENT meter M-2 to a value *not in excess of 350 milliamperes.* It may also be necessary to slightly readjust POWER AMPLIFIER TUNING (control F) L-14 for minimum value on P.A. PLATE CURRENT meter M-2 due to antenna effects. Optimum efficiency of operation is the condition giving maximum indication on ANTENNA CURRENT meter M-1 with minimum indication on P.A. PLATE CURRENT meter M-2. Refer to Fig. 34, or test data which accompanied this transmitter unit, for typical meter readings which were taken with the TUNE-OPERATE switch S-9 on OPERATE.

Note

In order to resonate the antenna it may be necessary to try various combinations of ANTENNA TUNING INDUCTANCE (control K) L-13 and ANTENNA TUNING CAPACITOR (control J) C-42, or VOLTAGE or CURRENT FEED to the antenna, to obtain maximum output to the antenna without the power amplifier being overloaded.

t. When operating the transmitter with the HIGH-LOW POWER switch S-5 in the LOW POWER position, the transmitter should be tuned as described. However, the following exceptions must be observed: The POWER AMPLIFIER TUNING (control F) L-14 and the P.A. GRID CURRENT meter M-3 are omitted. The ANTENNA COUPLING (control H) C-41 is so adjusted that the second intermediate amplifier (now used as a final amplifier) 2ND INT. AMP. PLATE CURRENT meter M-4 *does not exceed 150 milliamperes.* It is to be recalled that the upper limiting frequency is 9050 kcs. in the LOW POWER position.

u. The PLATE VOLTAGE meter M-9 should not exceed 3000 volts when using either HIGH or LOW POWER. This can be adjusted by the PLATE VOLTAGE rheostat R-33 on the transmitter unit. The 2000 volt armature of the high voltage generator unit is used to apply plate voltage (2100 volts maximum) to the Type —860 tubes first and second intermediate amplifier stages. This voltage is indicated on PLATE VOLTAGE meter M-9 on the transmitter when TUNE-OPERATE switch S-9 is on STEP 2. The PLATE VOLTAGE meter indicates the voltage which would be applied to the plate of the Type —861 tube if the HIGH-LOW POWER switch S-5A were on HIGH POWER.

v. After having tuned the transmitter unit as described, it can be started, keyed and stopped from a remote position by throwing the LOCAL-REMOTE switch S-7 to the REMOTE position. When the remote control unit is used, the START-STOP switch S-8 on the transmitter must be in the START position. The transmitter can always be stopped by the local START-STOP switch S-8, S-17 since this is supervisory over the remote starting switch.

18. ROUTINE OPERATION, TRANSMITTER.

a. GENERAL.

(1) Assuming that the transmitter has been calibrated for all of the desired operating frequencies, and that the master oscillator heater compartment is at operating temperature, routine operation may be accomplished as follows.

b. TO START AND STOP THE EQUIPMENT (ASSUMING THE FREQUENCY IS CORRECT).

(1) For local control, place the LOCAL-REMOTE switch S-7 to LOCAL. The equipment is then started or stopped by means of START-STOP switch S-8, S-17. For remote control of the TBM-12 equipment, place LOCAL-REMOTE switch S-7 in the REMOTE position. Place START-STOP switch S-8, S-17 in the START position. Place EMISSION switch S-405 on the modulator to VOICE, CW or MCW as desired. The equipment can then be controlled from a 4- or 6-wire remote control unit and/or a Type CRV-23172 or a Type CRV-23211 radiophone unit.

c. TO CHANGE FREQUENCY.

(1) Resume local control by placing the LOCAL-REMOTE switch S-7 in the LOCAL position for the remainder of the tuning period.

(2) Open TEST key S-10 and set TUNE-OPERATE switch to TUNING STEP 2.

(3) Set controls "A" to "L" according to the calibration chart for the desired frequency.

(4) If operating conditions permit, close TEST key S-10 and note the P.A. PLATE CURRENT meter

M-2 indicates between 150 and 250 ma. Set TUNE-OPERATE switch S-9 to OPERATE. With key closed all meters should indicate normally.

d. TO INCREASE AND DECREASE POWER.

(1) To decrease power, rotate GENERATOR FIELD rheostat counterclockwise until desired reduction is obtained. When phone transmission is being used, the SPEECH GAIN control R-401 in the modulator unit must be set to reduce the gain of the modulator. Quarter power may be obtained by this method.

(2) To increase power, rotate the GENERATOR FIELD rheostat clockwise until the desired power is obtained. When phone transmission is being used, SPEECH GAIN control in the modulator unit must be set to increase gain. Do not exceed 3000 volts as indicated by PLATE VOLTAGE meter M-9. If power less than quarter normal is desired, place HIGH-LOW POWER switch S-5 in the LOW position and set controls "E," "H," "J" and "K" as calibrated for LOW power. This mode of operation is available for frequencies betwen 2000 and 9050 kcs., for CW telegraph transmission.

19. MODULATOR OPERATION.

a. GENERAL.

(1) Although the radio transmitter may be operated independently of the modulator, when the transmitter and modulator are associated and connected together, the mode of transmission is selected by CW-MCW-VOICE switch S-405, which is located on the modulator unit. When the CW-MCW-VOICE switch S-405 is turned to either MCW or VOICE position, a resistor is inserted in the 3000 volt plate lead to reduce the transmitter power amplifier plate voltage to the proper value for modulation (2700 V.). It is also necessary at the same time to readjust the power amplifier output coupling, so that approximately 70% of the rated CW output power (350 watts) is obtained at this low value of plate voltage without modulation. The current input to the power amplifier plates should be 270 ma. at 2700 volts when the output power is 350 watts. When making this adjustment no modulation should be applied. CW-MCW-VOICE switch should be in the VOICE position and all audio voltage from the line input to the modulator should be removed before attempting this adjustment.

(2) In the following it must be assumed that the transmitter is connected and placed in operation in accordance with the Installation and Adjustment Sections of this instruction book. This, of course, has been done with the modulator CW-MCW-VOICE switch S-405 turned to the CW position. The modulator is started simultaneously with the transmitter by means of the START-STOP switch S-8, S-17 on the transmitter. It can also be remotely started by a similar switch on the Navy Type —23005 standard 4-wire remote control unit or Type —23146 standard 6-wire remote control unit which is located on the operator's desk. When radiophone unit Navy Type CRV-23172 or CRV-23211 is used, the transmitter and modulator may also be started and stopped from these units.

b. MCW OPERATION.

(1) Turn CW-MCW-VOICE switch S-405 on the modulator unit to VOICE. Turn carrier on with transmitter TEST key S-10. Readjust transmitter power amplifier coupling so that 70% of normal output on CW is obtained with 270 ma. plate input current to the power amplifier. Turn the CW-MCW-VOICE switch to MCW and key as desired. MCW modulation control R-409 has ben set at the factory for 100% modulation and should require no adjustment. Check meter readings per the following table:

TYPICAL METER READINGS

Meter	MCW Modulation		Voice Modulation MANUAL-AUTOMATIC GAIN Switch in MANUAL Position	
	Key Up	Key Down	0% Modulation	100% Modulation
INPUT AMPL. PLATE M-401 CURRENT meter (ma.)	0	0	3	3
INT. AMPL. PLATE M-402 CURRENT meter (ma.)	120	130	120	140
MODULATOR PLATE M-403 CURRENT meter (ma.)	50	160	50	160
PERCENTAGE MODULATION M-405 meter (%)	60	60	0	100
FILAMENT VOLTAGE M-406 voltmeter (Volts)	10	10	10	10
MODULATOR PLATE M-404 CURRENT meter (ma.)	50	160	50	160

Note

PERCENTAGE MODULATION meter M-405 is short circuited during MCW operation and is, therefore, inoperative. When this meter is in the inoperative stage, it does not read zero but somewhere near mid-scale. This is the condition also with CW-MCW-VOICE switch S-405 in the VOICE position, but with no carrier or modulation. When carrier is applied with no modulation, the meter reads zero.

(2) The Type CAY-50065-B modulator unit may be used as a part of a number of different equipments, some of which provide vacuum tube keying. To prevent improper operation, a warning appears on the name-plate of the CW-MCW-VOICE switch S-405 that in the MCW position vacuum tube keying should not be used.

(3) While it is not necessary to select special tubes for the operation of the modulator, it is advisable to discard those with characteristics which, through long life, abuse or other causes, differ considerably from the

specification requirements of the particular tube. In order that the distortion may be reduced to a minimum, it is desirable that the tubes which operate in opposite sides of the push-pull amplifier, VT-405 and VT-406, be similar. This makes it desirable to select tubes of approximately equal mutual conductance whenever this selection may be conveniently made. In the case of the Type —803 tubes used as modulators, a check on their similarity may be had by referring to above table.

c. VOICE OPERATION.

(1) Adjust radio transmitter power amplifier coupling as described in paragraph 19*b*. Leave CW-MCW-VOICE switch S-405 in VOICE position. Remove handset HS-401 from the microphone hook. Place CARRIER CONTROL switch S-403 in the MANUAL position. Press the Press-to-Talk switch and talk into the microphone. Adjust SPEECH GAIN attenuator R-401 until PERCENTAGE MODULATION meter M-405 indicates that the transmitter is being modulated. The microphone should be held approximately one inch from the mouth and spoken into with a normal conversational tone.

(2) SPEECH GAIN attenuator R-401 should be increased only to the point sufficient to obtain approximately 60% modulation when the syllable "Ah" is spoken into the test microphone of handset HS-401. Owing to the wave shape of most speech syllables, PERCENTAGE MODULATION meter M-405 will indicate considerably less than 100% modulation under ordinary operation even though the instantaneous power values may somewhat exceed 100% modulation.

(3) Care should be taken to see that the meters M-403, M-404 and M-405 do not materially exceed the values given in the above table during normal operation. While several measures are incorporated in the modulator for protection of the equipment, it is advisable not to exceed 100% modulation during ordinary operation in order to avoid the distortion which inevitably results from over-modulation. The most satisfactory method of determining the exact setting for satisfactory modulation is by listening to the rectified radio frequency signal locally, or by obtaining reports from a distant receiving station. After the readings of the instruments have once been correlated with the reception tests, they may be used as a means of duplicating satisfactory operation.

(4) In order to become familiar with the operation of the various controls it is desirable that the operator adjust each of them several times after reading the next section. The adjustment of SPEECH GAIN attenuator R-401 will generally be different for the handset HS-401 and for the remote speech input equipment.

(5) Whenever handset HS-401 is used for modulation purposes, it is necessary to press the Press-to-Talk switch located on the handset before talking. This switch controls the transmitter carrier power through relay K-401 and the transmitter keying relay. Therefore, it prevents modulation or emission of any sort unless it is pressed. Its function is duplicated by TALK switch S-404, which may be used instead.

(6) When the equipment is operating satisfactorily as adjusted above, CARRIER CONTROL switch S-403 should be placed in the VOICE RELAY position. The VOICE RELAY SENSITIVITY attenuator R-413 should be advanced to approximately 3 on the dial. When the microphone is spoken into, PERCENT MODULATION meter M-405 and MODULATOR PLATE CURRENT meters M-403 and M-404 should indicate approximately the same as the above table. Under VOICE RELAY condition, it is still necessary to press the Press-to-Talk button on the local microphone or place switch S-404 to TALK when using the local microphone for modulation. However, when modulation is derived from one of the remotely located speech input equipments, the voice relay circuit automatically puts the transmitter into operation, and removes carrier power after modulation ceases without any manual operations. The exact position of the VOICE RELAY SENSITIVITY attenuator R-413 for the best operation may be determined by remote reception tests as in the case of SPEECH GAIN attenuator R-401 above. When necessary, it may be adjusted by observations made on a local receiver. By adjustment of the VOICE RELAY SENSITIVITY attenuator R-413, the carrier can be obtained in approximately 0.025 second after starting to talk into the microphone. This minute fraction is approximately the time required to pronounce the letter "i" in the word "it." With correct adjustment, normal room noises in the vicinity of the microphone should not cause the voice relay to operate, although speaking into the microphone in normal conversational tone with the speaker's lips one inch from the microphone will operate the relay. Additionally, the adjustments should be such that none of the syllables in each word or speech period should be lost nor should the carrier be shut off during a continuous speech period.

(7) It should be remembered that, with the CARRIER CONTROL switch S-403 in the VOICE RELAY position, radiation occurs whenever the microphone is spoken into, without the manual operation of any switches. When the VOICE RELAY SENSITIVITY attenuator R-413 is advanced toward maximum, extraneous noises near the microphone may cause undesired transmission. If this occurs to an objectionable degree, sensitivity should be reduced or manual operation from the remote speech input equipment may be substituted by changing CARRIER CONTROL switch S-403 to the MANUAL position. With the local microphone in use, VOICE RELAY SENSITIVITY attenuator R-413 should be turned up to 3 or 4 on the dial. With remote speech input it may be turned up beyond the mid-position as far as noise conditions will permit.

d. CONTROLS.

(1) In the above description of the operation of the MCW and VOICE features of the modulator, mention has been made of the panel TALK switch S-404. This switch is used for the purpose of controlling the carrier directly from the panel. It has three positions:

(a) The lower or local position which gives sustained carrier output.

(b) The upper or momentary position which may be used to intermittently open or close the transmitter KEYING RELAY and thereby operate like a key.

(c) The center or OFF position in which the carrier is off.

(2) Both upper and lower TALK positions energize the local microphone when it is off the hook, and duplicate the function of the Press-to-Talk switch on the handset. This does not control the carrier when the CARRIER CONTROL switch S-403 is in the VOICE RELAY position; that is, when carrier is controlled by the voice relay feature of the modulator. The operation of TALK switch S-404 is therefore dependent on the setting of CARRIER CONTROL switch S-403 and dependent on the microphone hook. It is possible by means of these various controls to obtain the following operations.

e. CARRIER CONTROL SWITCH S-403 IN MANUAL POSITION.

(1) Local handset in place on hook.

(a) Control and modulate carrier from Navy Types CW-23071-2 speech input equipments; or radiophone units Types CRV-23172 or CRV-23211.

(b) Control carrier with TALK switch S-404 (either momentary or locked position).

(2) Local handset removed from hook.

(a) Control and modulate carrier from local handset (by use of Press-to-Talk switch).

(b) Control carrier and energize local microphone by operation of panel TALK switch S-404 (either momentary or locked position).

f. CARRIER CONTROL SWITCH S-403 IN VOICE RELAY POSITION.

(1) Local handset in place on hook.

(a) Carrier controlled by proper audio level in 600 ohm modulator input circuit.

(b) Position of panel TALK switch S-404 does not affect operation per *(a)* above.

(2) Local handset removed from hook.

(a) Carrier controlled by proper audio level in modulator input circuit (audio voltage derived from local microphone; 600 ohm input circuits from remote units opened by hook switch).

(b) Local microphone may be energized by operation of handset Press-to-Talk button or panel TALK switch S-404 in either momentary or locked position, but carrier is controlled only when microphone is spoken into.

g. AUTOMATIC GAIN OPERATION.

(1) It is always desirable in a communication system to utilize power to the maximum of its capability. To this end, volume controls such as R-401 are used for the purpose of manually maintaining the percentage modulation as high as possible for different levels of speech input. It is sometimes desirable to accomplish the same end automatically, to relieve the operator of the necessity of watching the volume closely and to make modulated output less subject to human variables. Automatic operation of this type is obtained through the medium of MANUAL-AUTOMATIC GAIN switch S-402, when placed in the AUTOMATIC position.

h. When MANUAL-AUTOMATIC GAIN switch S-402 is placed to the AUTOMATIC position, automatic gain operation is effected by tube VT-409, Type —25Z5, in conjunction with tubes VT-401 and VT-402. Tubes VT-401 and VT-402 are of the so-called super control type. The gain of these tubes is very sensitive to changes in grid bias, a fact which makes them suited for the purpose of automatic gain control. Audio voltage from one of the windings of transformer T-404 is applied through potentiometer R-432 to the left-hand plate of tube VT-409 as shown on the schematic diagram. This action increases or decreases the negative grid bias on tubes VT-401 and VT-402 up to the level corresponding to 100% modulation of the transmitter. From very low audio levels, up to that corresponding to 100% modulation of the transmitter, tube VT-409 acts as a compressor to increase the gain for small signals. Thus for minus 35 db. input, the gain is increased approximately 17½ db. more than the gain for zero db. input.

i. Beyond 100% modulation, tube VT-409 acts as a limiter. The voltage from the same winding of transformer T-404 is now of such a value to override a predetermined bias on the right-hand plate of tube VT-409. This will apply additional negative bias to the grids of tubes VT-401 and VT-402. In this way excessive amounts of modulation are effectively limited and consequent undesirable results considerably reduced. A check on the operation of the automatic gain feature is obtained as follows: Place MANUAL-AUTOMATIC GAIN switch S-402 to the AUTOMATIC position. Turn SPEECH GAIN attenuator R-401 to obtain minimum attenuation, or to 20 on the dial. Now, apply a steady tone into the microphone, such as a whistle, starting softly and gradually increasing in loudness until about 80% modulation is shown on PERCENTAGE MODULATION meter M-405. Do this several times so that an idea of the loudness of the tone is

while the local operator is making adjustments. This difficulty can be eliminated as follows: Place REMOTE-LOCAL switch S-7 to LOCAL, lock transmitter TEST key S-10 and use modulator handset HS-401 Press-to-Talk switch to operate the modulator. Thus, the equipment can be completely adjusted under LOCAL control, and switched to REMOTE after adjustments are completed. The CARRIER ON indicator lights, on all connected radiophone units, are energized whenever the Press-to-Talk switch on any one radiophone unit is pressed, even though the transmitter is under LOCAL control and is not available to remote operators. However, under LOCAL control the POWER indicator lights on the radiophone units do not light when the Press-to-Talk switches on these units are pressed. This is evidence to the remote operator that carrier is not actually available under such conditions.

c. The modulator should always be operated with the filament voltage at the correct value of 10 volts. Too high or too low voltage will cause damage to the vacuum tubes. Filament voltage may be adjusted by means of FILAMENT VOLTAGE rheostat R-415. This voltage is indicated on FILAMENT VOLTAGE meter M-406.

d. If the equipment is operated on reduced power by reduction of power amplifier plate voltage, it is important to readjust SPEECH GAIN attenuator R-401 before returning to full power operation. Otherwise over-modulation and the accompanying distortion will result. PERCENT MODULATION meter M-405 should be watched to guard against this.

e. The modulator is inoperative when the transmitter is used at 75 watts output from the intermediate amplifier, with the power amplifier not functioning. Therefore CW emission only is available. CW-MCW-VOICE switch S-405 should always be in the CW position, during this mode of transmission.

f. It is unnecessary to re-adjust tap settings on resistors R-414, R-419, R-420, and R-421. Since there is zero bias on vacuum tubes VT-405 and VT-406 it is unnecessary to make any adjustments in the grid circuit of these tubes. Any plate current unbalance up to $\pm 15\%$ is permissible and should cause no concern. The transmitter power amplifier plate current should be maintained at the proper value of 270 milliamperes and the plate voltage at 2700 volts when CW-MCW-VOICE switch S-405 is in either the VOICE or MCW position.

g. All meter readings should be approximately in accordance with the table given in paragraph 19*b* when the equipment is in normal operation. In case of doubt, it is desirable to move TALK switch S-404 to TALK position and CARRIER CONTROL switch S-403 to MANUAL. Then observe that all meter indications are normal. In doing this, care must be taken not to interrupt conversations from the remote speech input equipment or unnecessarily cause interference contrary to communication regulations.

obtained. While maintaining this note, turn SPEECH GAIN attenuator R-401 to 12 on the dial. If the automatic gain is working correctly, the percentage modulation should drop to approximately 40%. If switch S-402 were placed to the MANUAL position for the same gain reduction, PERCENTAGE MODULATION meter M-405 would drop to approximately 20%.

20. ROUTINE OPERATION, MODULATOR.

a. After preliminary adjustments have been completed it should not be necessary to operate the controls except for test or for change in operating conditions. CARRIER CONTROL switch S-403 will be left at either one of the two control positions, VOICE RELAY or MANUAL, depending upon which kind of control is desired. Voice relay K-401 in conjunction with the voice relay tube circuit, functions entirely automatically. It is impossible for the remote operator to fail to transmit every word by forgetting to press a TALK button when CARRIER CONTROL switch S-403 is in the VOICE RELAY position. This is a great aid in preventing the omission of words or sentences from transmission. As in the case of many other fully automatic devices, it may be desirable at times to control the transmitter unit manually as by a key. At such times CARRIER CONTROL switch S-403 may be placed to the MANUAL position. Again, it may be desirable to disconnect control from the remote speech input equipment by removing handset HS-401 from the hook, or by placing CARRIER CONTROL switch S-403 to MANUAL and TALK switch S-404 to OFF. This makes it possible for the operator stationed at the modulator to cut off anyone talking at a remote position if it is so desired. The most important things to remember in connection with this switch are that (1) while CARRIER CONTROL switch S-403 is thrown to the VOICE RELAY position, and with power supplied to the equipments, radiation occurs whenever sound waves enter any remotely connected microphone without manual operation of any switches; (2) when switch S-403 is in the MANUAL position it is always necessary to energize the carrier before speaking into a microphone, or no transmission will be effected.

b. Carrier power cannot be controlled (turned on and off) from the modulator unless transmitter REMOTE-LOCAL switch S-7 is in the REMOTE position. With 4-wire control it is impossible to start the motor-generator set unless the controller circuit is completed in the 4-wire remote control unit Navy Type —23005 or radiophone unit Navy Type CRV-23172. Additionally, it is impossible to check performances, during VOICE operation, from the modulator test handset unless transmitter REMOTE-LOCAL switch S-7 is in the REMOTE position. These conditions might lead to difficulties, since in REMOTE operation the radiophone-unit indicator lights give the remote operator the impression that the equipment is ready for operation, thereby causing him to attempt to use the equipment

b. It is desirable that PERCENT MODULATION meter M-405 be occasionally observed during transmission, and SPEECH GAIN attenuator R-401 adjusted if necessary. Before adjusting this control, the operator should assure himself that the audio levels from the remote speech input equipment are correct. Approximately 0.4 milliwatt audio level is necessary for 100% modulation. This 0.4 milliwatt refers to the input level to terminals 1 and 2 of the modulator.

i. The approximate performance of the modulator is given below:

Audio Input	0.4 milliwatt
Filament Power	200 va.
From 300 Volt Screen Supply	75 ma.
From 40 Volt Suppressor	10 ma.
2000 Volt Plate Supply	320 ma.
From 275 Volt Exciter Supply	400 ma.
Output Percent Modulation	100%
Output in Audio Watts to Plate of Radio Transmitter	365 watts
Output to Screens of Radio Transmitter Power Amplifier	10 watts
Audio Power Gain, Volume Control Minimum	30 db.
Audio Power Gain, Volume Control Maximum	60 db.
Fidelity—(100 to 5000 cycles)	±2 db.
Distortion—10% at 95% Modulation	
Voice Relay Start, Minimum Time Required	.025 sec.
Voice Relay Stop, Maximum Time Required	0.2 sec.

j. When using the local microphone on handset HS-401 remember that removing this handset from its hook disconnects the incoming 600 ohm audio line, and disconnects any speech coming over this line into the modulator. The volume of input to the receiver of handset HS-401 is controlled by RECEIVER VOLUME attenuator R-429 which is mounted on the front panel.

k. MANUAL-AUTOMATIC GAIN switch S-402 should be placed to the position corresponding to the mode of operation desired; that is, to AUTOMATIC in case automatic gain control is desired, or to MANUAL in case it is desired to control the gain manually.

21. MOTOR-GENERATOR AND MAGNETIC CONTROLLER OPERATION.

a. While reading the following text, reference should be made to the schematic diagram Fig. 19, Dwg. W-7300875, also refer to paragraph 18*a* through 18*d*.

b. The sequence of control for applying power to the transmitter equipment is as follows:

(1) Closing the power line switch to the magnetic controller applies power to the transmiter for operation of the master oscillator heat control system. This power is at the voltage of the supplying line and appears at terminals 9 and 10 on the transmitter unit. This power, for the operation of the master oscillator heat control system, also supplies the transmitter control circuit.

(2) The master oscillator heat control system and the transmitter control circuit are protected by fuses F-1 and F-2. These fuses are connected in the lines from terminals 9 and 10 in the transmitter.

(3) To start the motor-generator unit, place the LOCAL-REMOTE switch S-7 to LOCAL and place the START-STOP switch S-8, S-17 to START. If EMERGENCY SWITCH S-12, door interlocks S-14, S-15 and S-16 and master oscillator plate overload relay K-7 are all closed, operation of the START-STOP switch S-8, S-17 will close starting contactor K-4.

(4) Closing of contactor K-4 energizes contactor K-9 by action of contact K-4E, provided main plate overload relay K-5 is closed. Closing of contactor K-4 and contactor K-9 occurs almost simultaneously, and the STARTING SOLENOID indicator light I-2 (red) and the PLATE VOLTAGE indicator light I-3 (red) will light.

(5) Closing of contactor K-9 connects the high voltage generator field to the terminals of the bias generator through GENERATOR FIELD rheostat R-33. It also connects the low voltage generator field to the same terminals through resistor R-13. In this manner the generator fields are connected across the bias generator armature when contactor K-4 closes.

(6) As starting contactor K-4 closes, it also completes the magnetic controller solenoid circuit through contact K-4D which starts the motor-generator. The magnetic controller will function properly after the starting contactor K-4 has closed, provided controller overload relay K-854 is closed.

(7) After the magnetic controller solenoid K-852A-M has become energized, the action of the controller is as follows: The main contact K-852B will open. It should be noted that interlock K-851F, of contactor K-851, will prevent contactor K-852 from becoming energized unless contactor K-851 is open. Interlock K-852C will in turn energize main coil K-835A of contactor K-853. Its main contact K-853B will open, thereby inserting the whole starting resistor R-851 in the motor circuit. Interlock contact K-853C will close and complete the circuit to coil K-851A of line contactor K-851. This will close and connect the motor to the line with the starting resistor in the circuit. The "make" interlock K-851E will close and seal contactor K-851 on the line. The "break" interlock K-851F will open and de-energize contactor coil K-852A-M. The accelerating "break" contact K-851D will open and place more impedance in series with coil

K-851A. The coil will not draw more current than is necessary to keep the armature sealed once it is pulled in. Contact K-852B will remain open after K-852A-M is de-energized because the holding coil K-852A-H has been energized by a portion of the current flowing through the resistor R-851. This is done by connecting control resistor R-852 in parallel with the final portion of R-851 and then connecting holding coil K-852A-H in parallel with R-852. When starting current flows through resistor R-851, part of this current flows through R-852 and through coil K-852A-H. When the motor is at rest, this current is very large and enough flows through K-852A-H to prevent contact K-852B from closing. As the motor speed increases the current through R-851 and K-852A-H decreases. At some predetermined motor speed, the current through K-852A-H becomes so small that the magnetic pull is not enough to hold the contact armature in. The armature drops out and K-852-B closes. The motor speed at which K-852A-H is de-energized is predetermined by the position of the tap from K-852A-H to resistor R-852. When main contact K-852B closes, it shorts the first portion of R-851 and thus completes the first step of the starting cycle. Also, when K-852A-H is de-energized, interlock contact K-852C will open, thus de-energizing main coil K-853A-M. Contact K-853B will remain open after coil K-853A-M is de-energized because K-853A-H remains energized. Coil K-853A-H is also connected in parallel with R-852. Since resistor R-852 is in parallel with the final portion of R-851, the current in R-852 goes up again when contact K-852B shorts out the first section of R-851. When the current in R-851 rises, the current in K-853A-H also rises and contact K-853B remains open. At some predetermined motor speed, the current through K-853A-H becomes so small that the contactor armature drops out and contact K-853B closes. When this happens, the second or final step of R-851 is shorted out and the motor armature is now connected across the full line voltage. The speed at which coil K-853A-H is de-energized is determined by the position of the tap from K-853A-H to resistor R-852. When coil K-853A-H is de-energized, interlock K-853C is opened. This contact is connected in parallel with K-851E. When contactor K-851 was first energized, K-851E closed and shorted out K-853C and locked in contactor K-851.

(8) Interlock contact K-852D is connected between terminals T-1 and T-2 in the magnetic controller. This contact is in series with the tube filament supply from the slip rings on the motor. When contactor K-852 is energized, K-852D opens, thus opening the filament supply line. When K-852 is de-energized at the end of the first step, contactor K-852D closes again, the filament supply line is closed and the filaments are lighted. When K-852D closes, the motor has attained sufficient speed so that the filament transformer will not overload the circuits. Interlock contact K-853D is in series with the keying relay coil K-1A when 4-wire control is used. When K-853 is energized, K-853D opens and remains open until contactor K-853 is de-energized at the end of the second step. By this time the motor has come up to full speed and keying has been prevented until the motor has reached the proper speed.

(9) The motor will stop when START-STOP switch S-8, S-17 is placed in the STOP position because one side of the line to the line contactor coil K-851A is opened by contact K-4D. Contactor K-851A will be de-energized and disconnect the motor from the line. The motor will also stop if overload relay K-854 trips or if the supply voltage fails. If the overload has been tripped, the motor cannot be started until the relay has been reset.

SECTION V

MAINTENANCE

WARNING

When servicing the units always discharge the filter capacitors as some may be holding dangerous charges even though power may not be on the set. There are bleeder resistors or other circuits across the power filter capacitors, but the precaution of grounding them is essential in case the capacitors have not completely discharged. When shutting down the equipment never reach inside any unit until the motor-generator set has stopped revolving, as dangerous potentials are generated at all speeds. All necessary precautions should be taken to prevent injury to personnel.

22. GENERAL.

a. Keeping the equipment in good operating condition is absolutely essential to proper performance. Becoming familiar with the design of any equipment is the first essential for obtaining optimum performance. Various precautions should be observed for this reason as well as for safety reasons.

b. An accurate record should be kept on all vacuum tubes. This record should contain date of receipt, date placed in service, use intended, hours operated, date of failure and other pertinent information. Do not allow hot tubes to chill quickly by coming in contact with cold or moist surfaces as breakage may result. Important information on the care and operation of vacuum tubes will be found under Section VI.

c. Do not adjust zero readings of the meters with the power on. It is desirable to have a grounding rod (an insulated rod with a flexible insulated wire fastened at one end of the rod and to ground) to attach to circuits or parts before touching them with the hand. *Always ground internal apparatus before touching it, even though the power switch has been opened.*

d. The appearance of all of the units may be maintained by carefully dusting the entire exterior surface daily with a soft dry cloth. Occasionally it may be desirable to clean the back and side shields with a cloth that has been moistened with alcohol or uncolored carbon tetrachloride. When painting in the vicinity of the equipment, cover the units with wrapping paper so that the exterior of the set can be kept free from globules of paint. Do not paint over or attempt to finish exteriors of the units. If proper care is exercised, the original exterior finish can be maintained throughout the life of equipment. Molded or composition insulation, capacitor plates and moving mechanical parts should be cleaned with a dry cloth. Care should be taken that no scratches or damage are caused during the cleaning process. Where DRY compressed air is available, it should be used to blow the dust from the interior of the set. In the absence of a dry compressed air source, a hand bellows should be used.

e. When cleaning, never pull or strain the wiring as continued movement may cause breaks which are difficult to locate and repair. The felt strips between the wire clamps and the wire should be kept in place to prevent chafing of the wire.

f. Relays should be inspected regularly for rust, noise, and condition of contacts. If the contacts have become rough, they should be smoothed with a jeweler's file or crocus cloth. If badly burned they should be replaced with spares. Rust on the magnet armature or pole faces may cause noise and chattering and should be removed carefully. *Do not oil or grease relay bearings* as oil will collect dirt and introduce friction. See that all relays and interlocks work freely and are kept in proper adjustment. To neglect them may result in serious trouble which may be difficult to locate.

g. KEYING RELAY K-1 should be checked regulargly to see that the contacts are clean and the keying action is satisfactory. *Do not adjust contacts unless absolutely necessary.* The contacts of the KEYING RELAY are set at the factory with an oscillograph to produce proper keying. It is imperative that they be left as set, unless adjustment is absolutely necessary to eliminate arcing or to correct faulty keying. The contacts then should be adjusted as shown on Fig. 38.

h. Special care should be observed in keeping all switches in good condition, keeping them clean and with good contacts. The switch bearings should be given an occasional drop of oil.

i. Slider guides and contacts on the rotating coils should be kept clean and free from binding. A very thin application of No. 14-P-1-C lubricant may be used on the coils to prevent roughening of the copper.

j. All switches should be inspected regularly for rust and condition of contacts. It may be occasionally necessary to slightly bend the switch contact springs on CARRIER CONTROL switch S-403, hook switch S-401 and TALK switch S-404. Al contacts may require occasional cleaning with a very fine crocus cloth or a jeweler's file. If this is necessary, it should be followed by passing a piece of thin, closely woven cloth between the contacts to remove all abrasive particles. The interlock on switch S-405 should be kept in good condition, as neglect will result in serious trouble which may be difficult to locate. The contacts of switch S-405 should

be observed regularly to make sure they are in good condition. The switch bearings, *not the contacts,* should be given an occasional drop of oil.

k. If there is any evidence of salt deposits on the apparatus, it should be carefully washed with fresh water and dried. The salt deposit can be minimized by systematic routine interior cleanings.

l. The operations of voice relay K-401 should be observed at some remote receiving point to see that no syllables are lost and that the carrier does not drop off during continuous talk. The sensitivity of the voice relay circuit may be increased by means of the VOICE RELAY SENSITIVITY attenuator R-413 if necessary. Relay K-401 normally should give no trouble and, therefore, should not require readjustment. If, for any reason, the contacts should get out of adjustment, they may be readjusted as follows: By means of normally closed stationary contacts, adjust relays to just close with 6 ma. through the coil and with contact gap of .025 inches. Set contact gap to .025 inches by moving normally open contact. Lock contacts tight.

m. The magnetic controller should require very little care except for inspection of the contactors. Roughened appearance of the contacts is no indication that good contact is not being obtained. If the contacts become badly pitted or blackened, they may be cleaned and smoothed with a fine file and fine sandpaper. The copper contacts should be renewed when the tips are burned away to such an extent that current carrying surfaces are materially affected. Neglect to change the contact tips may result in an arc which will burn the contact screw, making it difficult to remove. *Open the main line switch to make sure that there is no voltage on the controller when servicing.* Push the contactors closed by hand to see that no friction is present and to make sure of proper contact alignment.

n. The bearings of the hinge pin and armature shaft require no lubrication. Oil quickly collects dust and, unless parts are frequently cleaned, will interfere with the action of the contactor. The sealing surfaces of the magnet core and armature should be kept clean to insure proper contact.

o. The commutators of the motor-generator unit should be inspected occasionally to see that the brushes are not sparking excessively and that the commutators are not burned or grooved. The commutators should be kept clean and the brushes properly adjusted and fitted to the curvature of the commutators. No other attention is required by the commutator when it takes on a polish and shows no signs of wear. *The commutators should never be lubricated.* If they become slightly rough they may be polished with a piece of fine sand-stone ground to fit. In any case the final smoothing should be done with a piece of fine (No. 00) sandpaper. When using the stone or paper, lift the brushes and do not replace them until all grit is removed.

CAUTION

Never use emery cloth or emery paper on the commutators. Never attempt to make repairs to the commutator and brushes when the machine is running, as the voltages are dangerous to life. Turn the motor-generator over by hand.

p. The brushes are set at the factory in the position for best commutation. This adjustment should not be altered. New brushes should be of the same make and grade as those shipped with the machine. When new brushes are installed the pigtails should be free and flexible. Spring tension on the brushes should be adjusted for 3 to 5 pounds per square inch.

q. The bearings of the motor-generator should be inspected regularly to make sure that they are properly lubricated. See paragraph 23*e*. The method of securing the motor-generator to the bed plate is by means of bolts screwed into tapped holes. The units are also dowelled as any misalignment will cause excessive ripple voltage. Special dowel pins are used which allow the pins to be removed from their holes. The units may be removed from the bed plate by disengaging the bolts and dowel pins. The couplings on the shafts are designed to permit disengaging of the units without moving them apart.

r. In order to obtain the extreme frequency stability of which the transmitter unit is capable, the master oscillator should be kept in excellent condition. Inspect the unit regularly to see that the heated compartment is holding temperature correctly, and that the thermostat relay K-20 functions properly. Keep the thermostat relay contacts in good condition and replace them with spares if they become worn. It is advisable to keep the heated compartment up to temperature continuously if possible. This prevents large variations in temperature in all parts of the frequency control circuit. All connections in the master oscillator unit should be kept tight and free from corrosion or dirt. Ordinarily, any trouble in unstable frequency can be traced to loose or dirty connections in the master oscillator unit.

s. Calibration reset capacitor C-61 is located in the master oscillator heat compartment. Adjustment is made from the front panel of the unit by unlocking the knurled lock-nut (see Fig. 1) and inserting a long slender screwdriver in the hole provided. This adjustment changes the capacity of a small variable capacitor. In this manner, small changes in dial calibration due to aging of parts or changing of master oscillator tubes may be corrected.

t. Microphone supply Rectox rectifier RX-401 is adjusted to supply 11 to 13.5 volts across capacitors C-401 and C-423. Due to the aging of the Rectox, it may be necessary to move taps connecting the Rectox A.C. terminals to terminals 7 and 9 on transformer T-408.

When this is done, care should be taken so as not to impress more than the maximum of 13.5 volts across capacitor C-401 when the filament voltage is adjusted to 10 volts ± 2 per cent. Tests for this voltage should be made with the microphone or handset HS-401 on the hook.

u. PERCENT MODULATION meter M-405 is a ratio meter. It has no torque spring and consequently its indication, when no current is flowing, is indefinite. Zero adjustment, therefore, is superfluous and none is provided. To determine if the instrument is indicating correctly, the following tests may be conducted. Disconnect the external leads from the terminals of the instrument. Pass 270 ma. of direct current from the positive terminal through the instrument to the negative terminal. The meter should read zero. Now, without changing the amount of direct current, pass 191 ma. of 60 cycle current through the winding connected to the terminals marked A.C. The instrument should indicate 100 per cent modulation. If the instrument indications are substantially different from those just cited, the instrument should be returned to the supplier for repair, following the instructions given under the contractual guarantee for the return of defective material.

v. Access to all parts of the master oscillator assembly, that may need servicing at any time, may be obtained from the left-hand side of the transmitter unit. This is accomplished by removing the left side shield of the transmitter, the shield of the master oscillator assembly and the heater compartment cover. All parts of the master oscillator, with the exception of the doubler circuit coupling capacitor C-13, M.O. plate choke grounding capacitor C-12, doubler circuit tuning capacitor C-14, 1st int. amp. grid coupling capacitor C-15, doubler tank coil L-3 and M.O. plate choke L-4, are then accessible. If necessary to correct trouble in the doubler circuit consisting of parts C-12, C-13, C-14, C-15, L-3 and L-4, the master oscillator unit should be removed from the frame as follows:

(1) Remove the left side and rear screens of the transmitter frame. Remove the midsection of the left back frame angle by unbolting it from the gussets. This frame angle is 39⅜ inches long is secured by four machine screws at each end.

(2) Disconnect all connections to the unit at the main frame terminal blocks on the bottom, front and top. Do not overlook the grid connection at the right side of the unit. Mark leads for convenience in replacement.

(3) Remove the rubber buffer pads and braces across the left side and back of the unit.

(4) Secure a block of wood approximately 2" x 4" having a length of approximately 10".

(5) Slip this block on the frame floor so as to support the master oscillator unit. Loosen the hose clamps between the fan and the unit.

(6) Mark the position of locknuts on turnbuckles, tying them with a string. Loosen the turnbuckles as far as they will extend. The locknuts provided on the turnbuckles are set for proper suspension and position of the master oscillator unit and should not be moved.

(7) Reach underneath to the right-hand corner of the unit and slip a wire loop through the end of the spring where it catches into the spring hook. Pull the spring with the wire loop and guide the spring out of the hook. The other three springs can be similarly unhooked.

(8) Disconnect all the top springs from the unit.

(9) With one man grasping the master oscillator unit at the back, and another at the front through the tube door, gently slide the unit out through the opening at the left side of the main frame. The unit can be rested on the block while changing hand holds. Be careful not to damage the fan motor.

w. The unit can be replaced in the main frame by reversing the process described in Par. 22*v*.

x. The rubber used in this equipment for shock-mounting should be inspected regularly and should be replaced if it becomes badly cracked. The rubber used for the tube mountings may be replaced by removing the mounting screws from the holders. The rubber used for cushioning the master oscillator unit may be replaced by first removing the unit from the main frame, following the instructions given above.

y. Mercury thermostats and mercury or spirit thermometers are delicate instruments which should be handled with extreme care to avoid breakage. In spite of such care, the column may separate while the glass is still intact. In such situations, it is usually practicable to reunite the column by placing the instrument in a beaker of water at a temperature of about 40 degrees C. Then gradually add warmer water until the column reunites. In the case of a thermostat operating at about 60 degrees C., the final temperature of the water in the beaker will rarely have to exceed 65 to 75 degrees C. After the column has been reunited the instruments should be gradually cooled and then tested for proper operation.

z. When thermostats with leads are supplied for use or as replacements in equipment provided with clips which do not require leads, it is preferable to cut the leads carefully rather than use a soldering iron. The reason for such care is that the leads are soldered to rings on the thermostat. These are constructed of copper wire and solder which in turn connect with the platinum wires which extend through the glass and make contact with the mercury.

23. LUBRICATION.

a. The tuning dial bearings, rotating coil bearings, variable capacitor bearings and the switch bearings should be lubricated at least once every six months with a few drops of a light penetrating oil such as a good No. 2075 oil.

b. The bearings of switch S-405 should be lubricated at least once every six months with a light machine oil. Do not lubricate the bearings or contacts of K-401 or any of the other relays.

c. The switch contacts and blades should be lubricated with a thin coat of No. 14-P-1-C lubricant. Do *not* lubricate the MASTER OSCILLATOR RANGE switch contacts S-1.

d. Blower motor B-1, in the master oscillator compartment, is fitted with ball bearings and should be greased once or twice a year, depending upon the service, with Navy Grade 14L3 medium grease. The bearings should never be more than two-thirds full.

e. The motor-generator is equipped with ball bearings and is shipped with sufficient grease in the bearings to provide for six months or more of service. Do not screw down the grease cups unless the bearings are actually in need of lubrication. Excessive grease is detrimental to ball bearings. A hot bearing is not an indication of insufficient grease but rather may be indicative of too much grease. A clicking bearing is an indication of insufficient lubrication or, possibly, a defective bearing. At intervals of six months or more of service, for normal operation, the bearings should be greased. Use a high grade sodium base, clean, ball bearing grease, similar to that supplied with the set, or Navy Grade 14L3 soft. When lubricating, remove bearing drain plug and, with set running, force in clean grease at the grease cups until clean grease appears at the outlets. Allow set to operate for about 15 minutes and then replace drain plugs. At intervals of about two years, the bearing caps should be removed, the bearings washed out and repacked with clean grease. *Keep grease and ball bearings clean; dirt destroys ball bearings.*

24. MAINTENANCE SCHEDULE.

Note

A maintenance schedule, based on the following hints, and strictly adhered to, will do much to keep the equipment in good operating condition with a minimum of shut-down time for repairs.

a. DAILY.

(1) Check all control circuits for proper operation.

(2) Check and record all meter and thermometer readings in log book.

(3) Check tuning of equipment on at least three frequencies.

(4) Dust exterior of equipment.

b. WEEKLY.

(1) Carefully clean entire equipment inside and out.

(2) Inspect and tighten all electrical connections.

(3) Clean and inspect all contactor and relay contacts.

(4) Clean all switch blade contacts.

c. MONTHLY.

(1) Check all tubes. This can be done by checking the daily meter readings in the log of the transmitter. Any gradual change in the tube will be indicated by a gradual change in plate current, all other factors being constant. The tubes in need of replacement can thereby be attended to without serious loss of power.

(2) Check brushes, commutator, and collectors for wear and sparking.

(3) Check bearings for lubrication. (Be careful not to get any dirt in bearings.)

d. YEARLY.

(1) Clean and repack the bearings of blower motor B-1.

25. TROUBLES AND CAUSES.

a. OPERATING START-STOP SWITCH S-8, S-17 ON THE RADIO TRANSMITTER UNIT DOES NOT OPERATE THE STARTING SOLENOID.

(1) Some access door open.

(2) REMOTE-LOCAL switch S-7 in wrong position.

(3) Overload relays not reset.

(4) Power supply switch open.

(5) No line voltage, or line voltage too low.

(6) EMERGENCY SWITCH S-12 open.

(7) Fuse F-2 open.

b. OPERATING START-STOP SWITCH S-8, S-17 IN THE TRANSMITTER UNIT DOES NOT START THE MOTOR-GENERATOR.

(1) Main line switch open.

(2) Some access door on the transmitter or modulator unit open.

(3) Magnetic controller or transmitter overload relays not reset.

(4) No line voltage, or line voltage too low.

c. MOTOR-GENERATOR UNIT OPERATES SATISFACTORILY BUT LOW PLATE VOLTAGE AT TRANSMITTER OR MODULATOR UNITS.

(1) Overload relays not reset.

(2) TUNE-OPERATE switch S-9 on transmitter at TUNING STEP 1.

(3) Open connection to motor-generator unit.

(4) Fuses open in motor-generator unit.

(5) Field contactor K-9 on transmitter not closed.

d. OPERATING TEST KEY CAUSES NO INDICATION ON MASTER OSCILLATOR METERS.

(1) KEYING RELAY K-1 inoperative.

(2) Dirty keying contacts.

(3) No plate voltage on master oscillator.

(4) Open grid leak.

(5) Open screen or plate series resistor.

(6) Screen by-pass or plate by-pass capacitor broken down.

(7) Open interlock circuit or range switch.

e. TUNING DOUBLER TUNING CIRCUIT CAUSES EXTREME REACTION ON MASTER OSCILLATOR SCREEN CURRENT AND FREQUENCY.

(1) Inaccurate setting of dial "C." Doubler circuit tuned to fundamental instead of harmonic frequency.

f. FIRST INTERMEDIATE AMPLIFIER DOES NOT RESONATE.

(1) Doubler tuning circuit improperly tuned.

(2) Range switch S-2 in wrong position.

g. NO FILAMENT VOLTAGE.

(1) Transformer T-408 connection open.

(2) Starting contactor K-4 on transmitter not closed.

(3) Fuse F-401 or F-402 open.

h. MODULATOR OR AMPLIFIER TUBES OVERHEAT OR DRAW EXCESSIVE PLATE CURRENT.

(1) Bias too low. (This applies only to amplifier tubes.)

(2) Audio input too high.

(3) Amplifier grid circuits grounded.

(4) Modulation transformer T-405 or reactor L-404 short circuited.

(5) Defective tubes.

i. PERCENT MODULATION METER M-405 READS OVER 100%.

(1) Audio input too high.

(2) Antenna radiation from transmitter too low due to non-resonance.

(3) Transmitter power amplifier plate circuit open.

(4) PERCENT MODULATION meter M-405 indicating incorrectly.

j. OPERATION APPARENTLY NORMAL BUT RECEPTION REPORTS INDICATE AUDIO DISTORTION PARTICULARLY ON HIGH PERCENTAGE MODULATION.

(1) Off-resonant tuning of transmitter power amplifier.

(2) Insufficient excitation to transmitter power amplifier.

(3) Overmodulation: Note that VOICE modulation giving 100% modulation has an average percentage modulation usually below 40%.

k. OPERATION APPARENTLY NORMAL BUT RECEPTION REPORTS INDICATE LOSS OF SYLLABLES OR LOSS OF CARRIER DURING CONTINUOUS TALK.

(1) VOICE RELAY SENSITIVITY attenuator R-413 set too low.

(2) Audio input too low.

(3) SPEECH GAIN attenuator R-401 set too low.

(4) Defective tube VT-408.

(5) Improper contact adjustment of voice relay K-401.

l. VOICE RELAY CHATTERS.

(1) VOICE RELAY SENSITIVITY control R-413 set too high.

(2) Poor grounding of cable leads.

(3) Improper contact adjustment.

m. SPARK GAPS BREAK DOWN ON LESS THAN 100% MODULATION.

(1) Gap adjustment wrong. (Gap should be approximately 0.035 inch on transformer T-405 and 0.065 inch or reactor L-404.)

(2) Humidity extremely high.

(3) PERCENT MODULATION meter M-405 indicating incorrectly.

(4) Rough gap surfaces.

n. NOISE LEVEL HIGH WHEN USING REMOTE SPEECH INPUT EQUIPMENT BUT NORMAL WITH LOCAL TEST MICROPHONE HS-401.

(1) High room noise near remote microphone.

(2) Grounded audio line.

(3) Open audio line.

(4) Defective microphone.

o. AUDIO DISTORTION WHEN USING LOCAL HANDSET HS-401 BUT NORMAL WITH REMOTE SPEECH INPUT EQUIPMENT.

(1) Voltage across microphone filter capacitor C-423 low due to microphone supply Rectox rectifier RX-401 aging.

(2) Defective handset HS-401.

p. CIRCUITS OPERATE SATISFACTORILY BUT NO ANTENNA CURRENT OR POWER AMPLIFIER LOADING.

(1) Antenna circuits out of resonance.

(2) Antenna shorted out.

(3) Antenna ammeter open.

(4) Auxiliary screen grid connection off of Type —861 amplifier tube.

q. SET OPERATES NORMALLY WHEN KEY IS DOWN BUT AMPLIFIER TUBES DO NOT BLOCK WHEN KEY IS UP.

(1) Insufficient bias on tubes. Check brushes on bias generator.

(2) Open connection to bias generator, check fuse.

(3) Defective amplifier tube.

(4) Ground on keying circuit causes master oscillator to run continuously.

r. AMPLIFIER TUBE HEATS EXCESSIVELY WHEN KEY IS CLOSED AND ANTENNA CIRCUIT IS IN TUNE.

(1) Antenna too tightly coupled.

(2) Excessive plate voltage.

(3) Defective amplifier tube.

s. FREQUENCY HOPS OR JUMPS.

(1) Defective master oscillator tube. Be sure anchored filament type is used in the master oscillator.

(2) Variable grounds around the master oscillator circuit caused by loose box cover, loose screws, etc.

(3) Mounting screws of master oscillator tube socket making variable grounds with tube base. Tube base *should not* be grounded.

(4) Defective grid leak.

(5) Loose grid connection.

(6) Fluttering master oscillator plate supply voltage, caused by dirty commutator or defective brush.

t. MAGNETIC CONTROLLER OPERATES, BUT OVERLOAD RELAY TRIPS TOO QUICKLY.

(1) Overload relay set too low.

(2) Not enough current in holding coils of accelerating contactors K-852 and K-853.

26. CIRCUIT CHECKING, GENERAL.

a. In case trouble appears to be in the interlock circuits of the doors or switches, terminals are provided on transmitter terminal board which permit circuit checking to definitely locate such trouble. Switches S-1C, S-9B and S-2A, which are normally connected to the keying circuit, are connected between terminals 19 and 20 of the terminal board. This wiring provides the following circuit checking:

(1) Test between terminals 19 and 20. Check should show complete short circuit (zero ohms) if interlock switches S-1C, S-9B and S-2A are functioning properly. An open circuit would indicate that one or more of the above switches is open.

(2) Test between terminals 20 and 6 with LOCAL-REMOTE switch S-7 in the REMOTE position. Check should indicate approximately 625 to 850 ohms (the value of coils K-1 and K-2 in parallel). If the check indicates a higher resistance circuit, K-1 or K-2 coil circuit is defective.

(3) Test between terminals 12 and 13. Check should indicate a short circuit. If check indicates an open circuit, the trouble is due to defective door interlocks in the modulator.

(4) Test between terminals 15 and 16. Check should indicate a short circuit. If check indicates an open circuit, the trouble is due to a defective switch interlock on S-405 in the modulator.

(5) Test between S-18F and terminal 13. Check should indicate a short circuit. If check does not indicate a short circuit, overload relay contact K-5B is open.

(6) Test between terminals 12 and 40. Door interlock switches S-14, S-15 and S-16 and low voltage overload relay K-7 are in series between these terminals. (Be sure that terminal board access door is closed.) The check between these terminals should show a complete short circuit (zero ohms) if all interlocks are functioning properly. An open circuit indicates that one or more of the door interlocks or the low voltage overload relay K-7 contacts are not completing the circuit.

b. In case of an emergency, temporary operation may be obtained if the interlocks are out of order by shorting between terminals 19 and 20 or terminals 12 and 40.

SECTION VI

VACUUM TUBE DATA

Note

All tubes supplied with the equipment or as spares on the equipment contract shall be used in the equipment prior to employment of tubes from general stock.

27. GENERAL.

a. The Type —860 tubes in the master oscillator circuit of the transmitter should be of the anchored filament type; filament supported top and bottom in such a manner as to prevent contact variation and resultant variation in emitted signal. The use of an unanchored filament type tube may result in unstable operation of the transmitter. The anchored type of filament may usually be recognized by the color of the filament turn which wraps around the center support. When the tube is operated at normal voltage, this turn on the anchored type will be cold. On the unanchored type this turn will glow.

b. With respect to the Type —861 tube used in the power amplifier, it is desirable that the filament support rod be electrically connected to the filament. With tubes of Westinghouse manufacture having serial numbers 27200 or above, this connection is accomplished through resistors in the base of the tube. Equivalent construction is employed also by other manufacturers.

c. In cases of severe overload resulting in the overheating of the tube, the electron emission may be very slight or may be reduced to a point where oscillations will not start. Unless the overload has liberated a large amount of gas, the activity of the filament can usually be restored by operating the tube at normal filament potential for ten minutes with the plate potential off. This reactivating process can be accelerated by raising the filament potential to 12 volts but no higher. The useful life of all thoriated filament tubes is usually ended long before the filament burns out. If a tube loses its emission, and cannot be reactivated within a reasonable length of time by the method described above, it should be replaced by a new tube.

d. When placing a thoriated tube in operation for the first time, it is desirable to operate the filament for from five to ten minutes before plate voltage is applied. This serves a two-fold purpose. The hot filament tends to absorb any traces of gas that may be present in the tube and also permits the active material present in the filament to diffuse to the surface of the filament.

e. Ordinary care in the handling and use of the tubes will minimize accidental damage to the tubes. The tubes should be handled carefully and should not be allowed to snap into position when being placed in their sockets. In all cases, regardless of the use to which the tubes are put, careful handling and conservative operation will be amply repaid by the longer and more uniform tube life that will be obtained.

28. TRANSMITTER TUBES.

a. A total of four vacuum tubes, three Type —860 and one Type —861, are used in the transmitter unit.

b. The Type —860 is a four element or screen grid tube designed for use as an oscillator or power amplifier in the transmitting circuits. It has a rated output of 75 watts at 2000 volts potential. The filament requires 3.25 amperes at 10 volts, which should not fluctuate more than 5% from the rated value. Under normal operating conditions, the plate dissiptation should not exceed 100 watts. The screen grid requires very little power for proper functioning and, therefore, its potential should be kept as low as possible. The total dissipation of this grid should never exceed 10 watts.

c. The Type —861 tube is similar to the Type 860 tube except that it has a rated output of 500 watts at 3000 volts plate potential. Its filament requires 10 amperes at a potential of 11 volts which should not fluctuate more than 5% from its rated value. Its normal plate dissipation is 400 watts and its screen grid dissipation should never exceed 35 watts. Both the Type —860 and the Type —861 vacuum tubes are made with thoriated filaments which provide a large filament emission at low temperatures. In order to obtain satisfactory tube life these tubes should be handled with extreme care as they may be permanently injured if subjected to sudden shock. They should never be operated above their rating and when not installed in the transmitter should always be well secured and stowed in their original containers in an upright position.

d. The following tabulations compare the actual operating condition of the tubes used in the transmitter unit with the ratings listed in the Navy Tube Specifications.

(1) MASTER OSCILLATOR TUBE, TYPE —860

	Full Load Operating Data	Maximum Rating Listed in RE-13A-600B	Amount by Which Rating is Exceeded
A.C. Filament Voltage	10 Volts	10 Volts	None
D.C. Plate Voltage	700 Volts	3000 Volts	None
D.C. Plate Current	60 Ma.	150 Ma.	None
D.C. Grid Voltage	—100 Volts	. . . Volts	None
D.C. Grid Current	10 Ma.	40 Ma.	None
R.F. Grid Current	0.050 Amps.	10 Amps.	None
Plate Dissipation	20 Watts	100 Watts	None
Plate Power Input	42 Watts	300 Watts	None
Screen Input	6 Watts	10 Watts	None
Screen Voltage	300 Volts	. . . Volts	None

(2) FIRST INTERMEDIATE AMPLIFIER TUBE, TYPE —860

	Full Load Operating Data	Maximum Rating Listed in RE-13A-600B	Amount by Which Rating is Exceeded
A.C. Filament Voltage	10 Volts	10 Volts	None
D.C. Plate Voltage	2000 Volts	3000 Volts	None
D.C. Plate Current	88 Ma.	150 Ma.	None
D.C. Grid Voltage	—200 Volts	. . . Volts	None
D.C. Grid Current	15 Ma.	40 Ma.	None
R.F. Grid Current	0.10 Amps.	10 Amps.	None
Plate Dissipation	75 Watts	100 Watts	None
Plate Power Input	176 Watts	300 Watts	None
Screen Input	6 Watts	10 Watts	None
Screen Voltage	275 Volts	. . . Volts	None

(3) SECOND INTERMEDIATE AMPLIFIER TUBE, TYPE —860

	Full Load Operating Data	Maximum Rating Listed in RE-13A-600B	Amount by Which Rating is Exceeded
A.C. Filament Voltage	10 Volts	10 Volts	None
D.C. Plate Voltage	2000 Volts	3000 Volts	None
D.C. Plate Current	150 Ma.	150 Ma.	None
D.C. Grid Voltage	—200 Volts	. . . Volts	None
D.C. Grid Current	40 Ma.	40 Ma.	None
R.F. Grid Current	0.250 Amps.	10 Amps.	None
Plate Dissipation	100 Watts	100 Watts	None
Plate Power Input	300 Watts	300 Watts	None
Screen Input	8 Watts	10 Watts	None
Screen Voltage	250 Volts	. . . Volts	None

(4) POWER AMPLIFIER TUBE, TYPE —861

	Full Load Operating Data	Maximum Rating Listed in RE-13A-600B	Amount by Which Rating is Exceeded
A.C. Filament Voltage	11 Volts	11 Volts	None
D.C. Plate Voltage	3000 Volts	3500 Volts	None
D.C. Plate Current	350 Ma.	350 Ma.	None
D.C. Grid Voltage	—250 Volts	. . . Volts	None
D.C. Grid Current	75 Ma.	75 Ma.	None
R.F. Grid Current	1.5 Amp.	10 Amps.	None
Plate Dissipation	350 Watts	400 Watts	None
Plate Power Input	1050 Watts	1200 Watts	None
Screen Input	20 Watts	. . 35 Watts	None
Screen Voltage	460 Volts	. . . Volts	None

29. MODULATOR TUBES.

a. A total of nine tubes are used in the modulator. These tubes are:

2—Type —803
3—Type —807
2—Type —6D6
1—Type —25Z5
1—Type —1616

b. Filament characteristics of the various tubes are given in the following table:

Tube	Functions	Fil. Voltage	Type of Cathode
Navy Type —803	Modulator	10.0 V.	Thoriated Filament
Navy Type —807	Amp. Voice Relay	6.3 V.	Indirectly Heated
Navy Type —6D6	Amplifier	6.3 V.	Indirectly Heated
Navy Type —25Z5	Compressor Limiter	25.0 V.	Indirectly Heated
Navy Type —1616	Modulator Limiter	2.5 V.	Oxide Coated Fil.

c. The tubes used in the modulator must be operated with an average filament voltage equal to the rated value. The variation of this voltage should be within plus or minus 5%. The use of a filament voltage less than that recommended will, in time, result in a loss of emission due to too low a rate of diffusion of the active material to the filament surface. More than rated voltage will shorten the life of the tube by too rapid evaporation of the active material from the filament surface. During the stand-by period, the filament voltage should be maintained at rated value.

d. The operating life of thoriated filament tubes (in this case Navy Type —803), is ordinarily ended by decrease in electron emission. Decreased emission, however, may be caused by accidental application of too high filament voltage, too high plate voltage or operation at low filament voltage. If the over or undervoltage has not been continued for a long time, the activity can often be restored by operating the filament at its normal voltage for ten minutes or longer without plate or grid voltage. The reactivating process may be accelerated by increasing the filament voltage, to not higher than 20% above the normal value, for a few minutes.

e. The useful life of the thoriated filament tube is usually ended long before the filament burns out. If a tube loses its emission, and cannot be reactivated within a reasonable length of time by the method described above, it should be replaced by a new tube.

f. All tubes, except the Type —6D6 and the Type —25Z5, are provided with clamps which hold them positively from being vibrated or jarred out of their sockets. The Type —6D6 and the Type —25Z5 tubes are provided with pressure type clamps. It is advisable not to remove these tubes any oftener than is necessary, which means normally not before their life is over. Frequent removals and replacements would result in scarring the base of the tubes and possible looseness of the tubes, thus making it easier for them to work their way out of the sockets. If, for any reason, a tube clamp is removed from the tube shelf, it should be replaced immediately.

g. The following tabulations compare the actual operating conditions of the tubes in the modulator with the ratings listed in the Navy Tube Specifications.

CAUTION

Except where indicating instruments are already incorporated in the equipment, operating personnel should not attempt to measure potentials in excess of 500 volts within the equipment due to hazards to human life.

(1) AMPLIFIER TUBE, TYPE —6D6

		Max. Operating Value in Equip.	Max. Navy Rating RE-13A-600B
Ep	(DV)	250	250
Ip	(DMA)	8	10.9
Pp	(W)	2	. . .
Eg	(DV)	—7½	—3
Ig	(DMA)	0	0.5
Ig^2	(DMA)	3.5	3.5
Eg^2	(DV)	100	100
Ig^3	(DMA)	0	. . .
Eg^3	(DV)	0	. . .
Ef	(AV)	6.3	6.3
If	(AA)	0.3	0.325
Pi	(W)	2	. . .
Pg^3	(W)	0	. . .
Pg	(W)	0	. . .

(2) COMPRESSOR LIMITER TUBE, TYPE —25Z5

Ep	(DV)	125	125
Ip	(DMA)	100	100
Ef	(AV)	25	25
If	(AA)	0.3	0.325

(3) AMPLIFIER VOICE RELAY TUBE, TYPE —807

Ep	(DV)	250	600
Ip	(DMA)	120	120
Pp	(W)	25	25
Eg	(DV)	—16	. . .
Ig	(DMA)	0	5
Ig^2	(DMA)	16	. . .
Eg^2	(DV)	250	. . .
Ef	(AV)	6.3	6.3
If	(AA)	0.9	0.99
Pi	(W)	35	60
Pg	(W)	0	. . .

(4) MODULATOR LIMITER TUBE, TYPE —1616

		Max. Operating Value in Equip.	Max. Navy Rating RE-13A-600B
Ep	(DV) (peak inverse)	7000	*5500
Ip	(DMA) (average)	15	130
Ip	(DMA) (maximum)	350	800
Ef	(AV)	2.5	2.5
If	(AA)	5.0	5.0

*Note: Permission has been granted by the tube manufacturer (RCA Radiotron Corp.) to use this tube at 7000 volts inverse peak provided average plate current does not exceed 15 ma. and maximum plate current does not exceed 350 ma.

(5) MODULATOR TUBE, TYPE —803

		Max. Operating Value in Equip.	Max. Class B Rating
Ep	(DV)	2000	2000
Ip	(DMA)	160	160
Pp	(W)	125	125
Eg	(DV)	0	0
Ig	(DMA)	25	. . .
Ig^2	(DMA)	35	. . .
Eg^2	(DV)	300	300
Ig^3	(DMA)	5	. . .
Eg^3	(DV)	40	40
Ef	(AV)	10	10
If	(AA)	5	5
Pi	(W)	640	640
Pg^3	(W)	1	. . .
Pg	(W)	5	(approx.) 5

*Note: Inasmuch as there is no Class B audio rating in RE-13A-600B, the rating is given as supplied by the tube manufacturer (Westinghouse Lamp Co.).

TABLE I

LIST OF MAJOR UNITS FOR

MODEL TBM-12 RADIO TRANSMITTING EQUIPMENT

QUANTITY 115 V.D.C.	QUANTITY 230 V.D.C.	SYMBOL GROUP	NAVY TYPE DESIGNATION	NAME OF MAJOR UNIT	ASSEMBLY DRAWING NUMBER
1		1 TO 99	CAY-52217	TRANSMITTER	DL-7502613 G-1
	1	1 TO 99	CAY-52218	TRANSMITTER	DL-7502613 G-9
X	X	211 TO 220	CAY-21679	LOW VOLTAGE AND BIAS GENERATOR	DL-7502615 L-21
X	X	221 TO 240	CAY-21680	HIGH VOLTAGE GENERATOR	DL-7502615 L-20
	X	241 TO 260	CAY-21681	MOTOR	DL-7502615 L-19
X		271 TO 290	CAY-21678	MOTOR	DL-7502615 L-5
	1	211 TO 260	CAY-21686	MOTOR GENERATOR COMPLETE	DL-7502615 G-2
1		211 TO 240, 271 TO 290	CAY-21675	MOTOR GENERATOR COMPLETE	DL-7502615 G-1
1	1	401 TO 499	CAY-50065-B	MODULATOR	DL-7502614 G-3
1		841 TO 850	CAY-211231	MAGNETIC CONTROLLER	DL-7502882 G-2
	1	851 TO 860	CAY-211232	MAGNETIC CONTROLLER	DL-7502882 G-1

TABLE II

NOTE - THIS SPARE PARTS LIST HAS BEEN COMPILED IN ACCORDANCE WITH NAVY SPECIFICATION RE13A730B WITH MODIFICATIONS AS DIRECTED BY THE RESIDENT INSPECTOR OF NAVAL MATERIAL AND APPROVED IN ACCORDANCE WITH BUREAU OF SHIPS LETTER. TO ALL INSPECTORS SERIAL 1095 (930 C B) EN28/A2-11 DATED 11 MAY 1944

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT											SPARE PARTS		
TOTAL USED PER EQUIP		SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	EQUIP.		ALL SYMBOL DESIGNATIONS INVOLVED
115 D.C.	230 D.C.										BOX NUMBER	QUANTITY	
1	1	B-1	BLOWER MOTOR	115 V.D.C. 3000 R.P.M. 1/75 H.P.	-21131B	17-M-9C	1	S#952446	1	7607280 P-1		1	B-1
2	2	B-1A	BEARINGS FOR B-1				1	2-D-695 IT.9	2	7607280 P-2		2	B-1A
2	2	B-1B	BRUSHES FOR B-1				1	8-D-2461 IT.2	3	7607280 P-3		10	B-1B
2	2		HOLDER FOR B-1B				1	8-D-2457 G-1	4	8-D-2483 P2		2	
2	2		SPRING FOR B-1B				1	426293	5	S#952446A		3	
									6				
0	1	B-241	MOTOR FOR M.G. SET	230 V.D.C.	-21681		1		7			0	B-241
1	0	B-271	MOTOR FOR M.G. SET	115 V.D.C.	-21678		1		8			0	B-271
2	2	C-1	CAPACITOR - M.O. TANK	0.00075 MFD. ±2%, 5000 V. EFF. TEST 2500 V. WORKING #(5,3.5,2,1), MICA CONSTANT CAPACITY AT 60°C	-48477-D2	RE48AA131C	2 17	654-6H 1550-H-215	9	7607280 P15		1	C-1,C-3
1	1	C-2	CAPACITOR - M.O. TANK	0.003 MFD. ±2%, 3000 V. EFF. TEST 1500 V. WORKING #(10,8,5,2), MICA CONSTANT CAPACITY AT 60°C	-48365-D2	RE48AA131C	2 17	655-6H 1550-H-225	10	7607280 P16		1	C-2
X	X	C-3	CAPACITOR - M.O. TANK	SAME AS C-1	-48477-D2				11				
10	10	C-4	CAPACITOR - M.O. FILAMENT BY-PASS	0.01 MFD. ±10%, 1000 V. TEST, 600 VOLTS WORKING, MICA	-48027-10	RE48AA112N	20		12	7607280 P18		2	C-4,C-5,C-8,C-9,C-17,C-18,C-26, C-27,C-35,C-36
2	2		BRACKET FOR C-4,C-12	MICARTA ANG. 1 OF 1 7/8 X 5/8 X 1/8 TK			1	7705580 P3	13	7406181 P2		0	
X	X	C-5	CAPACITOR - M.O. FIL BY-PASS	SAME AS C-4	-48027-10				14	7607280 P19			
1	1	C-6	CAPACITOR - M.O. SCREEN BY-PASS	0.1 MFD. ±5%, 1000 V. TEST EFF. 600 V. WORKING #(18,15,12,7),MICA	-48478-B5	RE48AA131C	20		15	7607280 P20		1	C-6
1	1	C-7	CAPACITOR - GRID BY-PASS	0.015 MFD. ±2%, 1500 VOLTS TEST EFF 750 VOLTS WORKING #(12,10,7,4) MICA CONSTANT CAPACITY AT 60°C	-48204-D2	RE48AA131C	2 17	140-6H 1550-H-311	16	7607280 P21		1	C-7
X	X	C-8	CAPACITOR - M.O. FIL BY-PASS	SAME AS C-4	-48027-10				17				
X	X	C-9	CAPACITOR - M.O. FIL BY-PASS	SAME AS C-4	-48027-10				18				

RESTRICTED

RESTRICTED

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
16	16	C-10	CAPACITOR M.O. SCREEN CURRENT METER BY-PASS	0.006 MFD. ±10%, 1000 V. TEST, 600 V.D.C. WORKING, MICA SUPPLY TYPE "E" BRACKETS SEPARATELY	-48410-10	RE48AA112N	20		19	7607280 P24		0	
-	0		CAPACITOR - SPARE FOR C-10	SAME AS C-10, EXCEPT OMIT "E" BKTS	-48410-10		20		20	7607280 P14		4	C-10,C-11,C-23,C-24,C-31,C-32, C-43,C-46, C-51,C-52,C-404, C-407,C-409,C-410,C-413,C-416
X	X	C-11	CAPACITOR - M.O. SCREEN CURRENT METER BY-PASS	SAME AS C-10	-48410-10				21				
6	6	C-12	CAPACITOR - M.O. PLATE BY-PASS	0.002 MFD., ±10%, 5000 V. TEST 2500 V.D.C. WORKING, MICA	-48037-10	RE48AA112N	20		22	7607280 P26		2	C-12,C-16,C-25,C-33,C-34,C-37
X	X		BRACKET FOR C-12	SAME AS ITEM 13					23				
1	1	C-13	CAPACITOR - DOUB. CIRCUIT COUPLING	0.000031 MFD. MAX., 0.000006 MFD. MIN., 0.0715" SPACING, VARIABLE AIR	-482390		3	MCD-35MX	24	7607280 P27		0	C-13
1	1	C-14	CAPACITOR - DOUB. TUNING	0.00075 MFD. MAX., 0.000024 MFD. MIN. VARIABLE AIR	-482391		4	X-750-ES	25	7605863 P4		0	C-14
1	1	C-15	CAPACITOR - 1ST INT. GRID COUP.	0.00007 MFD. ±10%, 5000 V. TEST 2500 V.D.C. WORKING, MICA	-48039-10	RE48AA112N	20		26	7607280 P29		1	C-15
1	1		PLATE FOR C-15	MICALEX 2 1/2 X 2 1/2 OF 1/4 TK			1	7705830 P2	27	7705830 P2		1	
X	X	C-16	CAPACITOR - 1ST INT. GRID CHOKE BY-PASS	SAME AS C-12	-48037-10				28				
8	8		BRACKET FOR C-16,C-19,C-25, C-28,C-34,C-35,C-36,C-37	MICARTA ANG. 1 OF 2 X 5/8 X 1/8 TK			1	7405902 P3	29	7707737 P3		0	
X	X	C-17	CAPACITOR - 1ST INT. FIL. BY-PASS	SAME AS C-4	-48027-10				30				
2	2		BRACKET FOR C-17,C-18,C-26, C-27	MICARTA ANG. 2 1/4 OF 5/8 X 1 7/8 X 1/8 TK			1	7405902 P5	31	7707737 P4		0	
X	X	C-18	CAPACITOR - 1ST. INT. FIL. BY-PASS	SAME AS C-4	-48027-10				32				
2	2	C-19	CAPACITOR - 1ST INT. SCREEN BY-PASS	0.01 MFD. ±10%, 2500 V.D.C. TEST 1200 V.D.C. WORKING, MICA	-48035-10	RE48AA112N	20		33	7607280 P33		1	C-19,C-28

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
X	X		BRACKET FOR C--19	SAME AS ITEM 29					34				
2	2	C-20	CAPACITOR - 1ST INT. PLATE BY-PASS	0.01 MFD., ±10%, 5000 V.D.C. TEST, 2500 V.D.C. WORKING, MICA	-48382-10	RE48AA112N	20		35	7607280 P34		1	C-20,C-30
1	1	C-21	CAPACITOR - 1ST INT. TUNING	0.00045 MFD. MAX., 0.000045 MFD. MIN., 0.08" SPACING, VARIABLE AIR			3	TC-450-BW	36	7607256 P3		0	C-21
20	20		INSULATOR FOR C-21,C-29,C-39	ISOLANTITE 2 3/8 X 1 X 1/4 TK			3		37			0	
1	1	C-22	CAPACITOR - 2ND INT. GRID COUPLING	0.00025 MFD., ±10%, 5000 V. TEST 2500 V.D.C. WORKING, MICA	-48330-10	RE48AA112N	20		38	7607280 P36		1	C-22
13	13		INSULATOR FOR C-22,C-55,R-22 S-4A,S-4B, VT-4 CONN.	ISOLANTITE - TAPERED 1 TO 1/2 X 1 LG	-61028		23	7602239 P1	39	7406187 P2		7	
7	7		BINDING POST FOR C-22,C-68				24	7407125 P1	40	7406187 P5		0	
1	1		STUD FOR C-22	BRASS 21/32 LG. SPECIAL			1	7400705 P12	41	7406187 P7		0	
1	1		STUD FOR C-22	BRASS 1 1/8 LG. SPECIAL			1	7406187 P9	42	7406187 P9		1	
X	X	C-23	CAPACITOR - 1ST INT. PLATE CURRENT METER BY-PASS	SAME AS C-10	-48410-10				43				
X	X	C-24	CAPACITOR - 2ND INT. PLATE CURRENT METER BY-PASS	SAME AS C-10	-48410-10				44				
X	X	C-25	CAPACITOR - 2ND INT. GRID CHOKE BY-PASS	SAME AS C-12	-48037-10				45				
X	X		BRACKET FOR C-25	SAME AS ITEM 29					46				
X	X	C-26	CAPACITOR - 2ND INT. AMP. FIL. BY-PASS	SAME AS C-4	-48027-10				47				
X	X		BRACKET FOR C-26,C-27	SAME AS ITEM 31					48				
X	X	C-27	CAPACITOR - 2ND INT. AMP. FIL. BY-PASS	SAME AS C-4	-48027-10				49				
X	X	C-28	CAPACITOR - 2ND INT. SCREEN BY-PASS	SAME AS C-19	-48035-10				50				

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
X	X		BRACKET FOR C-28	SAME AS ITEM 29					51				
1	1	C-29	CAPACITOR - 2ND INT. AMP. TUNING	0.00016 MFD., DOUBLE SECTION, EACH SECTION. 0.00032 MFD., (0.08" SPACING ROUNDED PLATES 0.04" THICK) VARIABLE AIR	-482393		3	TCD-320-BW	52	7607256 P2		0	C-29
X	X		INSULATOR FOR C-29	SAME AS ITEM 37					53				
15	15		INSULATOR FOR C-29,C-39,S-5A, S-5B,S-5C	ISOLANTITE - TAPERED 1 TO 1/2 X 1 1/2 LG	-61084		23	7602239 P39	54	7607288 P5		8	
2	2		WORM FOR C-29,C-39				25	7406747 P4	55	7406747 P4		0	
2	2		WORM WHEEL FOR C-29,C-39				25	7808130 P1	56	7607288 P4		0	
X	X	C-30	CAPACITOR - 2ND INT. AMP. PLATE BY-PASS	SAME AS C-20	-48382-10				57				
X	X	C-31	CAPACITOR - P.A. PLATE CURRENT METER BY-PASS	SAME AS C-10	-48410-10				58				
X	X	C-32	CAPACITOR - P.A. GRID CURRENT METER BY-PASS	SAME AS C-10	-48410-10				59				
X	X	C-33	CAPACITOR - P.A. GRID BLOCKING	SAME AS C-12	-48037-10				60				
X	X	C-34	CAPACITOR - P.A. GRID CHOKE BY-PASS	SAME AS C-12	-48037-10				61				
X	X		BRACKET FOR C-34	SAME AS ITEM 29					62				
X	X	C-35	CAPACITOR - P.A. FIL. BY-PASS	SAME AS C-4	-48027-10				63				
X	X		BRACKET FOR C-35	SAME AS ITEM 29					64				
X	X	C-36	CAPACITOR - P.A. FIL. BY-PASS	SAME AS C-4	-48027-10				65				
X	X		BRACKET FOR C-36	SAME AS ITEM 29					66				
X	X	C-37	CAPACITOR - P.A. SCREEN BY-PASS	SAME AS C-12	-48037-10				67				
X	X		BRACKET FOR C-37	SAME AS ITEM 29					68				
		C-38	NOT USED										

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
1	1	C-39	CAPACITOR - P.A. TUNING	0.00016 MFD. DOUBLE SECTION, EACH SECTION .00032 MFD. (0.10" SPACING ROUNDED PLATES 0.04" THICK) VARIABLE AIR	-482394		3	TCD-320-JW	69	7607256 P1		0	C-39
X	X		INSULATOR FOR C-39	SAME AS ITEM 37					70				
X	X		INSULATOR FOR C-39	SAME AS ITEM 54	-61084				71				
X	X		WORM FOR C-39	SAME AS ITEM 55					72				
X	X		WORM WHEEL FOR C-39	SAME AS ITEM 56					73				
1	1	C-40	CAPACITOR - P.A. PLATE BY-PASS	0.0005 MFD., ±5%, 7500 V. TEST. EFF. 3500 V. WORKING #(4,3,1.5,.5) MICA	-481215-5	RE48AA131C	2 17	592-6P 1550-335	74	7607280 P54		1	C-40
1	1	C-41	CAPACITOR - ANT. COUPLING	0.00006 MFD., VARIABLE AIR			1		75	7604452 G7		0	C-41
8	8		INSULATOR FOR C-41, VT-3, VT-4	ISOLANTITE TAPERED 1 3/8 TO 5/8 X 3 LG	-61030		23	7602239 P3	76	7604452 P15		4	
1	1		CONTACT FOR C-41	NICKEL SILVER 15/8X1 X 1/32 TK.			1	7806535 P1	77	7604452 P12		2	
1	1		LEAD SCREW FOR C-41	ST. STEEL 7 1/8 LG X 1/2 DIA. X6 ACME THD. 1 IN.			1	7405851 P2	78	7604452 P10		0	
1	1		SLEEVE FOR C-41	BRASS 6 1/8 OF 1 1/8 DIA. SPECIAL			1	7405851 P5	79	7604452 P11		0	
1	1		SPRING FOR C-41	PHOS. BRONZE 1/2 LG. X 23/32 DIA.			1	7807490 P1	80	7604452 P6		0	
1	1	C-42	CAPACITOR - ANT. TUNING	0.0003 MFD. MAX., 0.000052 MFD. MIN (0.23" SPACING) VARIABLE AIR	-482396		4	TK-300-US	81	7607403 P1		0	C-42
2	2		STRIP FOR C-42	MICALEX 13 1/2 X 1 OF 1/4 TK			4		82			1	
X	X	C-43	CAPACITOR - P.A. PLATE CURRENT METER BY-PASS	SAME AS C-10	-48410-10				83				
1	1	C-44	CAPACITOR - ANT. H.V. BLOCKING	0.004 MFD. ±5%, 3000 V. TEST EFF. 1500 V. WORKING #(11,8.5,5.5,2.5) MICA	-481289	RE48AA131	2 17 21		84	7607280 P58		1	C-44
3	3	C-45	CAPACITOR - KEYING RELAY ARC SUPPRESSOR	1.0 MFD., ±10%, 600 V.D.C. WORKING PAPER	-48686-10	RE13A488C	2 17 21	TJ-6010	85	7607280 P59		2	C-45, C-63, C-64

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
X	X	C-46	CAPACITOR - FIL. VOLTMETER BY-PASS	SAME AS C-10	-48410-10				86				
1	1	C-47	CAPACITOR - M.O. PLATE VOLTAGE FILTER	4 MFD., ±10%, 1000 V.D.C. WORKING PAPER	-48683-10	RE13A488	1	TYPE FL	87	7607280 P61		1	C-47
1	1	C-48	CAPACITOR - BIAS FILTER	6 MFD., ±10%, 600 V.D.C. WORKING, PAPER	-48684-10	RE13A488	1	TYPE FL	88	7607280 P62		1	C-48
1	1	C-49	CAPACITOR - PLATE VOLTMETER MULTIPLIER BY-PASS	0.001 MFD. ±5%, 7500 V. TEST EFF. 3500 V. WORKING, MICA	-481216-5	RE13A389K	2	246-6P	89	7607280 P63		1	C-49
X	X	C-50	NOT USED						90				
X	X	C-51	CAPACITOR - BIAS VOLTMETER BY-PASS	SAME AS C-10	-48410-10				91				
X	X	C-52	CAPACITOR - PLATE VOLTMETER BY-PASS	SAME AS C-10	-48410-10				92				
1	1	C-53	CAPACITOR - 2ND INT. AMP. TANK	0.00015 MFD. ±5%, 5000 V. TEST EFF. 2500 V. WORKING, 7.5 AMPS. AT 4500 KC., 6.0 AMPS. AT 3000 KC., 2.0 AMPS. AT 1000 KC., 1.5 AMPS. AT 300 KC., 0.35 AMPS. AT 100 KC, MICA	-48535-5	RE13A389K	2 17 21	661-59	93	7607280 P67		1	C-53
8	8		INSULATOR FOR C-53	ISOLANTITE	-61029		23	7602239 P2	94	7810310 P42		4	
1	1	C-54	CAPACITOR - P.A. TANK	0.00015 MFD. ±5%, 20,000 VOLTS TEST EFF 10,000 V. WORKING #(5,3.8,2.5, 1.3), MICA	-48534-5	RE13A389K	2 17 21	316-51	95	7607280 P68		1	C-54
3	3		INSULATOR FOR C-54 & ANT.	ISOLANTITE			23	7806601 P1	96	7810310 P97		0	
1	1	C-55	CAPACITOR - P.A. GRID COUPLING	0.000075 MFD. MAX., 0.000015 MFD. MIN. (0.07" SPACING) VARIABLE AIR			4	NP-75-DS	97	7607403 P4		0	C-55
2	2		STRIP FOR C-55	ISOLANTITE			4		98			0	
X	X		INSULATOR FOR C-55	SAME AS ITEM 39	-61028				99				
1	1	C-56	CAPACITOR - M.O. TANK	0.000375 MFD. ±2%, 5000 V. TEST EFF. 2.5 AMPS. AT 1000 KC., 2500 V. WORKING MICA, CONST. CAP. AT 60°C	-48481-D2	RE13A389K	2 17	656-6H	100	7607280 P70		1	C-56

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
1	1	C-57	CAPACITOR - P.A. GRID	0.000025 MFD. ± 5%, 10,000 V. TEST EFF., 5000 V. WORKING #(3,1.0,0.3, 0.5), MICA	-48423-5	RE13A389K	2 17		101	7607280 P71		1	C-57
2	?	C-58	CAPACITOR - H.V. FILTER	4 MFD., ±10%, 3000 V.D.C. WKG., PAPER	-48685-10	RE13A488C	1	TYPE FL	102	7607280 P72		1	C-58, C-65
		C-59	NOT USED										
1	1	C-60	CAPACITOR - THERMOSTAT RELAY SPARK SUPPRESSOR	0.5 MFD. ±10%, 400 V.D.C. WKG., PAPER	-48205A-10		2	DH-4050A	103	7607281 P74		1	C-60
1	1		SUPPORT FOR C-60	MICARTA ANG. 2 1/2 OF 1 5/8 X 5/8 X 1/8 TK			1	7705763 P4	104	7606524 P5		0	
1	1	C-61	CAPACITOR - CALIBRATION RESET	0.000002 MFD., VARIABLE AIR	-482408		1		105	7405440 G1		0	C-61
1	1		EXTENSION FOR C-61	MICARTA 3 3/16 OF 3/4 O.D. X 3/8 I.D.			1		106			0	
2	2		INSULATOR - STAND-OFF FOR C-61	ISOLANTITE 1 1/4 X 23/32 SQ.	-61032	RE61A209 RE13A317	23	7705360 P11	107	7405440 P10		1	
3	3		INSULATOR - STAND-OFF FOR C-61	ISOLANTITE 2 OF 1/2 SQ.	-61107	RE61A209 RE13A317	23	7705360 P14	108	7405440 P12		2	
1	1	C-62	CAPACITOR - COMPENSATING	0.00001 MFD., VARIABLE AIR, PART OF T-3			1		109	7810264 G3		0	C-62
X	X	C-63	CAPACITOR - BLOWER MOTOR BY-PASS	SAME AS C-45	-48686-10				110				
X	X	C-64	CAPACITOR - BLOWER MOTOR BY-PASS	SAME AS C-45	-48686-10				111				
X	X	C-65	CAPACITOR - H.V. FILTER	SAME AS C-58	-48685-10				112				
1	1	C-66	CAPACITOR - H.V. R.F. BY-PASS	0.0001 MFD., ±5%, 7500 V.D.C. TEST EFF. #(1.3,.5,.3,.1), MICA	-481214-5	RE48AA131	2 17	321-6P 1550-318	113	7607281 P80		1	C-66
1	1	C-67	CAPACITOR - P.A. SCREEN BY-PASS	0.0001 MFD. ±10%, 5000 V.D.C. TEST 2500 V.D.C. WORKING, MICA	-48001-10	RE48AA112N	2 17		114	7607281 P81		1	C-67
1	1	C-68	CAPACITOR - FREQ. METER R.F. COUPLING	SPECIAL ADJUSTABLE BAND ON CERAMIC INSULATORS		RE48AA112N	1		115	7407390 G1		0	C-68

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

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1	1		INSULATOR FOR C-68	ISOLANTITE 1 1/2 LG X 3/4 DIA.	-61068		23	7602239 P23	116	7407390 P5		1	
1	1		STUD FOR C-68	BRASS 3/4 LG. SPECIAL			1	7400705 P6	117	7407390 P11		0	
X	X		CONNECTOR FOR C-68	SAME AS ITEM 40					118				
4	4	C-401	CAPACITOR - MIC. FILTER	500 MFD., 15 V., +100%, -10%, ELECTROLYTIC	-48340	RE13A549A	17 2	G15-500 PL-5113E	119	7606286 P1		5	C-401,C-417,C-418,C-423
4	4		BD. SPACER FOR C-401,C-417 C-418,C-423	MICARTA 1 X 1/2 X 1/2			1	7707470 P3	120	7707471 P5		0	
2	2	C-402	CAPACITOR - BY-PASS	0.10 MFD. ±10%, 600 V. WORKING, OIL FILLED PAPER	-48197-A10	RE13A488C	2 17	DY-6010-1 630-1	121	7606286 P2		1	C-402,C-424
4	4	C-403	CAPACITOR - BY-PASS	1.0 MFD. ±10%, 400 V. WORKING, OIL FILLED PAPER	-482063-10	RE13A488C	17	15-515	122	7605848 P27		2	C-403,C-406,C-415,C-422
X	X	C-404	CAPACITOR - METER BY-PASS	SAME AS C-10	-48410-10				123			0	
0	0		CAPACITOR - METER BY-PASS	SPARE FOR C-404 - SAME AS C-10 EXCEPT OMIT "E" BRACKETS					124				
2	2	C-405	CAPACITOR - TONE OSCILLATOR	0.025 MFD. ±10%, 1000 V. TEST, 600 V. WORKING, MICA	-48591-10	RE13A389K	2 17	TYPE 4-11025 1445-.025	125	7606286 P5		1	C-405,C-412
X	X	C-406	CAPACITOR - BY-PASS	SAME AS C-403	-482063-10				126				
X	X	C-407	CAPACITOR - METER BY-PASS	SAME AS C-404	-48410-10				127				
2	2	C-408	CAPACITOR - MOD. COUPLING	2 MFD. ±10%, 3000 V., OIL FILLED, PAPER	-48526-10	RE13A488C	1	S.O. 38Y979 TYPE FL	128	7606286 P8		1	C-408,C-411
6	6		INSULATOR FOR C-408	ISOLANTITE 1 3/8 X 1 SQ.	-61043		23	7402331 P2	129	7606302 P6		3	
X	X	C-409	CAPACITOR - METER BY-PASS	SAME AS C-404	-48410-10				130				
X	X	C-410	CAPACITOR - METER BY-PASS	SAME AS C-404	-48410-10				131				
X	X	C-411	CAPACITOR - MOD. PLATE BY-PASS	SAME AS C-408	-48526-10				132				
X	X	C-412	CAPACITOR - MOD. METER	SAME AS C-405	-48591-10				133				
X	X	C-413	CAPACITOR - METER BY-PASS	SAME AS C-404, EXCEPT OMIT TYPE "E" BRACKETS	-48410-10				134	7606286 P13			
1	1	C-414	CAPACITOR - VOICE RELAY GRID	0.02 MFD. ±10%, 1000 V. TEST, 600 V. WORKING, MICA	-48428-10	RE13A389K	2 17	TYPE 4-11020 1445-.02	135	7606286 P14		1	C-414
X	X	C-415	CAPACITOR - BY-PASS	SAME AS C-403	-482063-10				136				

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
X	X	C-416	CAPACITOR - METER BY-PASS	SAME AS C-404	-48410-10				137				
X	X	C-417	CAPACITOR - FILTER	SAME AS C-401	-48340				138				
X	X	C-418	CAPACITOR - FILTER	SAME AS C-401	-48340				139				
1	1	C-419	CAPACITOR - BY-PASS	8 MFD., ±10%, 600 V., OIL FILLED PAPER	-481171-10	RE13A488C	2 17	7805848 P24 TJ-6080 609S-8	140	7606286 P19		1	C-419
2	2	C-420	CAPACITOR - SCREEN COUPLING	2 MFD. ±10%, 600 V.D.C. WORKING, OIL FILLED, PAPER	-48687-10	SEE NOTE	2	TYPE FL S#1173042	141	7605848 P25		1	C-420, C-421
X	X	C-421	CAPACITOR - BY-PASS	SAME AS C-420	-48687-10				142				
X	X	C-422	CAPACITOR - BY-PASS	SAME AS C-403	-482063-10				143				
X	X	C-423	CAPACITOR - FILTER	SAME AS C-401	-48340				144				
X	X	C-424	CAPACITOR - BY-PASS	SAME AS C-402	-48197-A10				145				
2	2	C-425	CAPACITOR - GAP SHUNT	0.0005 MFD. ±10%, 2500 V. WORKING 5000 V. TEST, MICA	-481170-10	RE48A154	2 17	4E-53050 1447E-.0005	146	7606233 P30		0	C-425, C-426
0	0		CAPACITOR - SPARE FOR C-425	SAME AS C-425 EXCEPT OMIT "E" BKTS	-481170-10				147	7606233 P30		1	
X	X	C-426	CAPACITOR - GAP SHUNT	SAME AS C-425	-481170-10				148				
6	6	E-211	H.V. BRUSH	USED ON 1000 V. GEN.			1	S#1133015	149	31-J-907 P55		30	E-211, E-221
2	2	E-212	L.V. BRUSH	USED ON 275 V. GEN.			1	S#1133016	150	31-J-907 P56		10	E-212
2	2	E-213	SHUNT & SERIES COILS	USED ON 1000 & 275 V. GENS.			1	L-372453	151	31-J-907 P16 P17 & P18		2	E-213
8	8	E-214	BRUSH HOLDER				1	S#1124399	152	33-J-176 P122		8	E-214, E-224
8	8	E-214A	HOLDER SPRING				1	S#848058	153	33-J-176 P42		12	E-214A, E-224A
8	8	E-215A	INSULATOR FOR HOLDER	ISOLANTITE			23	#334	154	33-J-176 P43		8	E-215A, E-225A
16	16	E-215B	WASHER FOR HOLDER	FIBRE			1	1-D-9054	155	33-J-176 P54		16	E-215B, E-225B
1	1	E-217	ARMATURE FOR G-211	1000 V., 0.075 A., 275 V., 0.92 A.			1	2-B-2764	156	33-J-176 P120		1	E-217
X	X	E-221	BRUSHES	SAME AS E-211					157				

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

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2	2	E-222	SHUNT & SERIES COILS	USED ON 2000-3000 V. GEN.			1	L-372452	158	33-J-174 P57		2	E-222
2	2	E-223	COMPOUND COMM. COILS	USED ON 2000-3000 V. GEN.			1	L-372452	159	33-J-174 P59		2	E-223
X	X	E-224	BRUSH HOLDER	SAME AS E-214					160				
X	X	E-224A	HOLDER SPRING	SAME AS E-214A					161				
X	X	E-225A	INSULATOR FOR HOLDER	SAME AS E-215A					162				
X	X	E-225B	WASHER FOR HOLDER	SAME AS E-215B					163				
1	1	E-228	ARMATURE FOR G-221	2000 V., 0.75 A., 3000 V. 0.35 A.			1	4-B-3824	164	33-J-174 P33		1	E-228
0	8	E-241	BRUSHES FOR B-241	D.C.			1	S#917122	165	33-J-178 P70		40	E-241
-	4	E-242	BRUSHES FOR B-241	A.C.			1	S#1133017	166	33-J-178 P42		20	E-242,E-272
0	2	E-243	FIELD COILS FOR B-241	COMMUTATING			1	L-367854	167	33-J-178 P88		2	E-243
0	4	E-244	FIELD COILS FOR B-241	SHUNT			1	L-367854	168	33-J-178 P87		4	E-244
-	8	E-245	HOLDERS FOR E-241				1	S#271764	169	33-J-178 P122		8	E-245,E-283
-	8	E-245A	SPRING FOR E-245				1	S#282836	170	33-J-178 P74		12	E-245A,E-275A
-	2	E-246	HOLDER FOR E-242	RIGHT -HAND			1	S#1124417	171	33-J-178 P120		2	E-246,E-276
-	2	E-247	HOLDER FOR E-242	LEFT - HAND			1	S#1124418	172	33-J-178 P121		2	E-247,E-277
0	4	E-247A	SPRING FOR E-246 & E-247				1	S#848058	173	33-J-907 P42		6	E-247A
-	4	E-248	INSULATION FOR E-245	MICARTA TUBE			1	S#285465	174	33-J-178 P65		4	E-248,E-278
-	2	E-249	INSULATION FOR E-246 & E-247	MICARTA TUBE			1	2-B-9099	175	33-J-178 P57		2	E-249,E-279
0	1	E-250	ARMATURE FOR B-241	230 VOLTS, 22 AMPS. D.C., 162 V. 3.3 AMPS. A.C.			1	2-B-9098	176	33-J-178 P117		1	E-250
8	0	E-271	BRUSHES FOR B-271	D.C.			1	S#916415	177	33-J-180 P70		40	E-271
4	-	E-272	BRUSHES FOR B-271	A.C. SAME AS E-242					178			20	
8	-	E-275A	SPRING FOR E-283	SAME AS E-245A					179			12	
2	-	E-276	HOLDER FOR E-272	SAME AS E-246					180			2	

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP BOX NUMBER	SPARE PARTS EQUIP QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
2	-	E-277	HOLDER FOR E-272	SAME AS E-247					181			2	
4	0	E-277A	SPRING FOR E-276 & E-277				1	S#848058	182	31-J-907 P42		6	E-277A
4	-	E-278	INSULATION FOR E-283	SAME AS E-248					183			4	
2	-	E-279	INSULATION FOR E-276 & E-277	SAME AS E-249					184			2	
2	0	E-281	FIELD COILS FOR B-271	COMMUTATING			1	L-367855	185	33-J-180 P88		2	E-281
4	0	E-282	FIELD COILS FOR B-271	SHUNT			1	L-367855	186	33-J-180 P87		4	E-282
8	-	E-283	HOLDER FOR E-271	SAME AS E-245					187			8	
1	0	E-284	ARMATURE FOR B-271	115 VOLTS, 44 AMPS. D.C., 81 VOLTS 6.6 AMPS. A.C.			1	2-B-9174	188	33-J-180 P117		1	E-284
2	2	F-1	FUSE - CONTROL CIRCUIT	6 AMPS., 250 V., NON-RENEWABLE		17-F-2G	22	CAT #25116	189	7607281 P89		20	F-1, F-2
1	1		HOLDER FOR F-1 & F-2	PORCELAIN FOR 2 FUSES			6	7605881 P4	190	7607287 P11		1	
X	X	F-2	FUSE - CONTROL CIRCUIT	SAME AS F-1					191				
1	1	F-211	FUSE	0.25 A., 5000 V.			5	#3022C	192	33-J-176 P66		20	F-211
1	1	F-212	FUSE	3 A., 250 V.			1	#7051	193	33-J-176 P84		10	F-212
1	1	F-221	FUSE	1 A., 5000 V.			5	#3025C	194	33-J-174 P92		20	F-221
1	1	F-222	FUSE	2 A., 5000 V.			5	#3026C	195	33-J-174 P93		10	F-222
2	2	F-401	FUSE - CONTROL & FILAMENT	3 A., 250 V., NON-RENEWABLE		17-F-2G	6	CAT #25003	196	7606286 P28		20	F-401, F-402
1	1		HOLDER FOR F-401 & F-402	PORCELAIN FOR 2 FUSES			6		197			0	
X	X	F-402	FUSE - CONTROL & FILAMENT	SAME AS F-401					198				
1	-	F-841	CONTROL FUSE	10 AMPS., 250 VOLTS			22	S#37160	199	45-J-406 P10		10	F-841, F-851
-	1	F-851	CONTROL FUSE	SAME AS F-841					200			10	
1	1	G-211	L.V. GENERATOR		-21679		1		201	31-J-907 P55		0	G-211
1	1	G-221	H.V. GENERATOR		-21680		1		202			0	G-221
1	1	HS-401	HANDSET	TELEPHONE TYPE COMBINATION MICROPHONE & RECEIVER	-51050		29	7707248 G1	203	7606286 P31		0	HS-401

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
2	2	1-1A	INDICATOR LAMP BIAS	LIGHT RECEPTACLE			1	SEE NOTE	204	7607281 P102		1	1-1A, 1-4A
8	8	1-1B	INDICATOR LAMP	LIGHT BULB, 18 V., 0.11 AMP.	TS-51		1	S#549474	205	7607281 P103		16	1-1B, 1-2B, 1-3B, 1-4B, 1-5B, 1-6B 1-401C, 1-402C, 1-403C
2	2	1-1C	INDICATOR LAMP	LENS GREEN			1	S#549469	206	7607281 P104		2	1-1C, 1-402B
3	-	1-2A	INDICATOR LAMP M.G.	LIGHT RECEPTACLE, 1200 OHMS, WITH MTG.			1	SEE NOTE	207	7607281 P105		1	1-2A, 1-3A, 1-5A
X	-	1-2B	INDICATOR LAMP	LIGHT BULB - SAME AS 1-1B	TS-51				208				
3	4	1-2C	INDICATOR LAMP	LENS - RED			1	S#549468	209	7607281 P107		2	1-2C, 1-3C, 1-6C, 1-401B, 1-403B
X	2	1-3A	INDICATOR LAMP	RECEPTACLE - SAME AS 1-2A					210				
X	X	1-3B	INDICATOR LAMP	LIGHT BULB - SAME AS 1-1B	TS-51				211				
X	2	1-3C	INDICATOR LAMP	LENS RED - SAME AS 1-2C					212			1	
X	X	1-4A	INDICATOR LAMP	RECEPTACLE -SAME AS 1-1A					213				
X	X	1-4B	INDICATOR LAMP	LIGHT BULB - SAME AS 1-1B	TS-51				214				
1	1	1-4C	INDICATOR LAMP	LENS - CLEAR			1	S#549470	215	7607281 P113		1	1-4C
X	X	1-5A	INDICATOR LAMP	RECEPTACLE - SAME AS 1-2A					216				
X	X	1-5B	INDICATOR LAMP	LIGHT BULB - SAME AS 1-1B	TS-51				217				
1	1	1-5C	INDICATOR LAMP	LENS - AMBER			1	S#549472	218	7607281 P118		1	1-5C
0	1	1-6A	INDICATOR LAMPQ	RECEPTACLE			1	S#867325B	219	7810310 P332		1	1-6A
-	X	1-6B	INDICATOR LAMP	LIGHT BULB - SAME AS 1-1B	TS-51				220				
-	X	1-6C	INDICATOR LAMP	LENS - SAME AS 1-2C					221				
2	2	1-401A	INDICATOR LAMP (PLATE VOLT.)	RECEPTACLE - INCLUDES RESISTOR			1	SEE NOTE	222	7606286 P32		1	1-401A, 1-403A
X	X	1-401B	INDICATOR LAMP	LENS - SAME AS 1-2C					223				
X	X	1-401C	INDICATOR LAMP	BULB - SAME AS 1-1B	TS-51				224				
1	1	1-402A	INDICATOR LAMP (BIAS VOLT)	RECEPTACLE - INCLUDES RESISTOR			1	SEE NOTE	225	7606286 P33		1	1-402A

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP 15 CC	TOTAL USED PER EQUIP 230 CC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
X	X	I-402B	INDICATOR LAMP	LENS - SAME AS I-1C					226				
X	X	I-402C	INDICATOR LAMP	BULB - SAME AS I-1B	TS-51				227				
X	X	I-403A	INDICATOR LAMP (START)	RECEPTACLE - SAME AS I-401A					228				
X	X	I-403B	INDICATOR LAMP	LENS - RED - SAME AS I-401B					229				
X	X	I-403C	INDICATOR LAMP	BULB - SAME AS I-1B	TS-51				230				
1	1	J-1	JACK - FREQUENCY METER	JACK AND CUP ASSEMBLY (INCLUDES -49021) JACK ONLY, TWO CIRCUITS NORMALLY CLOSED	-49110 -49021	RE49AA147A RE13A481D	8	SEE NOTE	231	7807281 P124		1	J-1
1	1	K-1	RELAY - KEYING	D.P.S.T., PLUS S.P.D.T., TWO BREAK PER CIRCUIT, NORMALLY THREE CIRCUITS OPEN & ONE CIRCUIT CLOSED.	-29169		1		232	7804741 G12		1	K-1
1	1		CONTACT BOARD FOR K-1	MICARTA 3 1/4 X 1 15/16 OF 3/16 TK			1	7808426 P1	233	7705079 P2		0	
6	6		CONTACT FOR K-1 MTG				27	7806282 P3	234	7705079 P4		2	
2	2		BLOCK FOR K-1 MTG.	MICARTA 2 1/8 X 2 OF 3/4 TK.			1	7705079 P10	235	7810310 P24		0	
1	1	K-2	RELAY - COMPENSATOR	S.P.D.T. SINGLE BREAK PER CIRCUIT 0.005 AMP. AT 50 VOLTS D.C. NORMALLY OPERATES AT 75 VOLTS D.C. ±20% WITH 5000 OHMS SERIES RESISTOR	-29050		7	SEE NOTE	236	7807281 P139		0	K-2
1	1	K-2A	COIL FOR K-2	0.005 AMP., 50 V.D.C. NORMALLY OPERATES AT 75 V.D.C. ±20% WITH 5000 OHM SERIES RESISTOR			7	TYPE "V"	237	7807281 P140		1	K-2A
2	2	K-2B	CONTACT FOR K-2	STATIONARY, 2 AMP., 110 V.A.C.			7	#2984	238	7807281 P141		1	K-2B, K-2C
2	2	K-2B	CONTACT FOR K-2	MOVING AND SPRING, 2 AMPS., 110 V. A.C.			7	#2071	239	7807281 P142		1	K-2B, K-2C
		K-3	NOT USED										
1	1	K-4	RELAY - MAIN STARTING	4 P.S.T., DOUBLE BREAK, THREE POLES NORMALLY OPEN, ONE POLE NORMALLY CLOSED	-29064		1	S#12864017A	240	9-A-3882 LINE 2		0	K-4
1	1	K-4A	COIL FOR K-4	600 T. #30 D.C.C. WIRE, RES. 344 OHMS			1	S#897943	241			1	K-4A

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
5	5	K-4B	CONTACT FOR K-4	STATIONARY			1	S#897644	242			3	K-4B,K-4C,K-4D,K-9B,K-9C
5	5	K-4B	CONTACT FOR K-4	MOVABLE			1	S#897622	243			3	K-4B,K-4C,K-4D,K-9B,K-9C
X	X	K-4C	CONTACT FOR K-4	SAME AS K-4B (STA.)					244				
X	X	K-4C	CONTACT FOR K-4	SAME AS K-4B (MOV.)					245				
X	X	K-4D	CONTACT FOR K-4	SAME AS K-4B (STA.)					246				
X	X	K-4D	CONTACT FOR K-4	SAME AS K-4B (MOV.)					247				
1	1	K-5	RELAY - H.V. OVERLOAD	S.P.S.T., ONE BREAK PER CIRCUIT NORMALLY CLOSED, SLOW ACTION, MANUAL RESET, 0.75 TO 3.0 AMP. OPERATING RANGE	-29195		1	S#1164031 TYPE "MN"	248	7710114 P3		0	K-5
1	1	K-5A	COIL FOR K-5	OPERATING RANGE, 0.75 TO 3.0 AMP. 1.6 OHMS RESISTANCE			1	S#1164028	249	7607282 P155		1	K-5A
2	2	K-5B	CONTACT FOR K-5	STATIONARY, .5 A., 230 V.A.C. OR D.C.			1	S#1202083	250	7607282 P158		1	K-5B,K-7B
2	2	K-5B	CONTACT FOR K-5	MOVING, .5 A., 230 V.A.C. OR D.C.			1	S#1202082	251	7607282 P157		1	K-5B,K-7B
2	2		BASE FOR K-5,K-7	MOLDING			1		252			0	
2	2		INSULATOR FOR K-5,K-7	MICARTA ANGLE			1		253			0	
		K-6	NOT USED										
1	1	K-7	RELAY - L.V. OVERLOAD	S.P.S.T. ONE BREAK PER CIRCUIT, NORMALLY CLOSED, 0.15 TO 0.6 AMP. OPERATING RANGE	-29196		1	S#1164029	254	7710114 P1		0	K-7
1	1	K-7A	COIL FOR K-7	OPERATING RANGE 0.15 TO 0.6 AMP. 42 OHMS RESISTANCE			1	S#1164026	255	7607282 P159		1	K-7A
X	X	K-7B	CONTACT FOR K-7	STATIONARY - SAME AS K-5B					256				
X	X	K-7B	CONTACT FOR K-7	MOVING - SAME AS K-5B					257				
X	X		BASE FOR K-7	SAME AS ITEM 209					258				
X	X		INSULATOR FOR K-7	SAME AS ITEM 210					259				
1	1		PANEL FOR C-60 & R-49	MICARTA 5 1/2 X 4 OF 1/4 TK			1	7705763 P2	260	7606529 P2		0	

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
1	1		TERM. BD. FOR C-60 & R-49	MICARTA ANG. 3 5/8 OF 1 5/8 X 1/2			1	7606529 P3	261	7606529 P3		0	
		K-8	NOT USED										
1	1	K-9	RELAY - FIELD CIRCUIT	D.P.S.T., TWO BREAKS PER CIRCUIT NORMALLY OPEN	-29062		1	S#1264016A	262	9-A-3882 LINE 1		0	K-9
1	1	K-9A	COIL FOR K-9	12,000 T. #33 WIRE, RES. 1375 OHMS			1	S#875799	263			1	K-9A
X	X	K-9B	CONTACT FOR K-9	SAME AS K-4B (STA)					264				
X	X	K-9B	CONTACT FOR K-9	SAME AS K-4B (MOV)					265				
X	X	K-9C	CONTACT FOR K-9	SAME AS K-4B (STA)					266				
X	X	K-9C	CONTACT FOR K-9	SAME AS K-4B (MOV)					267				
1	1	K-20	RELAY - THERMOSTAT		-29046		7	7609921 P1	268	7609529 P26		0	K-20
1	1	K-20A	COIL FOR K-20	11 V.D.C. +45% -23%, 12 MA. FOR RELAY CX-1968			7	COIL "I"	269			1	K-20A
X	X	K-20B	CONTACT FOR K-20	SAME AS K-2B (STA)					270				
X	X	K-20B	CONTACT FOR K-20	SAME AS K-2B (MOV)					271				
X	X		PANEL FOR K-20	SAME AS ITEM 217					272				
X	X		TERM. BD. FOR K-20, C-60 R-56, R-57 & R-58	SAME AS ITEM 218					273				
1	1	K-401	RELAY - VOICE	S.P.D.T., 1 BREAK PER CIRCUIT, CONTACT RATING 2 AMPS., 110 V., CONTACT GAP .025" DROP OUT TIME .006 SEC. COIL CUR. 6 MA. PICKUP	-29091		30	CAT #220937	274	7606218 P4		0	K-401
1	1	K-401A	CONTACT	STATIONARY - FOR K-401			30		275	7606286 P38		1	K-401A
1	1	K-401B	CONTACT	MOVABLE - FOR K-401			30		276	7606286 P39		1	K-401B
1	1	K-401C	COIL	1800 OHMS MAX. RESISTANCE 6 MA. - FOR K-401			30		277	7606286 P57		1	K-401C
1	-	K-841	CONTACTOR	TYPE IM-220	-29353		1		278	45-J-406 P1		0	K-841
1	0	K-841A	COIL	TWO WINDINGS, ONE 1760 TURNS #30 EN.CU. 55 OHMS RESIS. - SECOND WINDING 13350 - TURNS #33 EN. CU. 1210 OHMS RESIS.			1	S#1303531	279	37-J-922 P5		1	K-841A
2	-	K-841B	MAIN CONTACT	STATIONARY - FOR K-841			1	S#1303972	280	37-J-922 P1		2	K-841B, K-841C

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
2	-	K-841B	MAIN CONTACT	MOVABLE - FOR K-841			1	S#1303971	281	37-J-922 P2		2	K-841B, K-841C
X	-	K-841C	MAIN CONTACT	SAME AS K-841B, STA.					282				
X	-	K-841C	MAIN CONTACT	SAME AS K-841B, MOV.					283				
2	-	K-841D	CONTACT - STATIONARY	INTERLOCK, FOR K-841			1	S#1308214	284	37-J-922 P9		2	K-841D
1	-	K-841D	CONTACT - MOVABLE	INTERLOCK, FOR K-841			1	S#1308317	285	37-J-922 P10		1	K-841D
2	-	K-841E	CONTACT - STATIONARY	INTERLOCK, FOR K-841			1	S#1308250	286	37-J-922 P6		2	K-841E
1	-	K-841E	CONTACT - MOVABLE	INTERLOCK, FOR K-841			1	S#1308251	287	37J-922 P7		1	K-841E
2	-	K-841F	CONTACT - STATIONARY	INTERLOCK (SPECIAL) FOR K-841			1	S#1308181	288	37-J-922 P12		2	K-841F
1	-	K-841F	CONTACT - MOVABLE	INTERLOCK (SPECIAL) FOR K-841			1	S#1257419	289	37-J-922 P13		1	K-841F
2	-	K-841G	MAIN CONTACT SPRING	FOR CONTACTOR K-841			1	S#1308159	290	37-J-922 P3		2	K-841G
1	-	K-841H	KNOCKOUT SPRING	FOR CONTACTOR K-841			1	S#1308163	291	37-J-922 P4		1	K-841H
1	-	K-841J	SPRING	FOR CONTACTOR K-841			1	S#1308164	292	37-J-922 P8		1	K-841J
1	-	K-841K	SPRING	FOR CONTACTOR K-841			1	S#1297369	293	37-J-922 P11		1	K-841K
3	-	K-841L	SPRING	FOR CONTACTOR K-841			1	S#1289042	294	37-J-922 P14		3	K-841L, K-842H, K-843H,
2	-		INSULATION FOR K-841	ARC SHIELD			1	17-C-17	295	37-J-922 P16		0	
2	-	K-842	RELAY	TYPE IAQ-4111			1		296			0	K-842, K-843
2	0	K-842A	COIL	TWO WINDINGS - ONE 4,000 TURNS #31 EN. CU. 246 OHMS RESIS. - SECOND WINDING 2,052 TURNS #33 EN. CU. 250 OHMS RESIS.			1	S#1315390	297	37J-890 P5		1	K-842A, K-843A
2	-	K-842B	MAIN CONTACT	STATIONARY FOR K-842			1	S#1308318	298	37-J-890 P2		2	K-842B, K-843B
2	-	K-842B	MAIN CONTACT	MOVABLE FOR K-842			1	S#1308319	299	37-J-890 P1		2	K-842B, K-843B
4	-	K-842C	CONTACT - STATIONARY	FOR RELAY K-842			1	S#1258707	300	37-J-890 P6		4	K-842C, K-843C
2	-	K-842C	CONTACT - MOVABLE	FOR RELAY K-842			1	S#1257419	301	37-J-890 P7		2	K-842C, K-843C

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
4	-	K-842D	CONTACT - STATIONARY	FOR RELAY K-842			1	S#1258708	302	37-J-890 P9		4	K-842D, K-843D
2	-	K-842D	CONTACT - MOVABLE	FOR RELAY K-842			1	S#1312152	303	37-J-890 P10		2	K-842D, K-843D
2	-	K-842E	SPRING	FOR RELAY K-842			1	S#1312162	304	37-J-890 P11		2	K-842E, K-843E
2	-	K-842F	RETURN SPRING	FOR RELAY K-842			1	S#1258957	305	37-J-890 P3		2	K-842F, K-843F
2	-	K-842G	ARMATURE SPRING	FOR RELAY K-842			1	S#1258963	306	37-J-890 P4		2	K-842G, K-843G
X	-	K-842H	SPRING	FOR RELAY K-842, SAME AS K-841L					307				
X	-	K-843	RELAY	SAME AS K-842					308				
X	0	K-843A	COIL	SAME AS K-842A					309				
X	-	K-843B	MAIN CONTACT - STATIONARY	SAME AS K-842B, STA.					310				
X	-	K-843B	MAIN CONTACT - MOVABLE	SAME AS K-842B, MOV.					311				
X	-	K-843C	CONTACT - STATIONARY	SAME AS K-842C, STA.					312				
X	-	K-843C	CONTACT - MOVABLE	SAME AS K-842C, MOV.					313				
X	-	K-843D	CONTACT - STATIONARY	SAME AS K-842D, STA.					314				
X	-	K-843D	CONTACT - MOVABLE	SAME AS K-842D, MOV.					315				
X	-	K-843E	SPRING	FOR RELAY K-843 - SAME AS K-842E					316				
X	-	K-843F	RETURN SPRING	FOR RELAY K-843 - SAME AS K-842F					317				
X	-	K-843G	ARMATURE SPRING	SAME AS K-842G					318				
X	-	K-843H	SPRING	FOR RELAY K-843 - SAME AS K-842H					319				
1	0	K-844	OVERLOAD RELAY	MI HEATER			1		320			0	K-844
1	0	K-844A	HEATER FOR K-844	53 AMPS.			1	S#1265734	321	36-J-639 P22		1	K-844A
0	0	K-844B	OVERLOAD RELAY - LESS HEATER	MI			1		322			0	K-844B
-	1	K-851	CONTACTOR	TYPE IM-220, WITH COIL S#1303532	-29354		1		323	45-J-408 P1		0	K-851
0	1	K-851A	COIL	TWO WINDINGS, ONE 3520 TURNS #33 EN. CU., 200 OHMS RESIS. - SECOND WINDINGS 26,700 TURNS #36 EN. CU. 4850 RESIS.			1	S#1303532	324	37-J-922 P5		1	K-851A

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
-	2	K-851B	MAIN CONTACT - STATIONARY	SAME AS K-841B, STA.					325			2	K-851B, K-851C
-	2	K-851B	MAIN CONTACT - MOVABLE	SAME AS K-841B, MOV.					326			2	K-851B, K-851C
-	X	K-851C	MAIN CONTACT - STATIONARY	SAME AS K-841B, STA.					327				
-	X	K-851C	MAIN CONTACT - MOVABLE	SAME AS K-841B, MOV.					328				
-	2	K-851D	CONTACT - STATIONARY	SAME AS K-841D, STA.					329			2	K-851D
-	1	K-851D	CONTACT - MOVABLE	SAME AS K-841D, MOV.					330			1	K-851D
-	2	K-851E	CONTACT - STATIONARY	SAME AS K-841E, STA.					331			2	K-851E
-	1	K-851E	CONTACT - MOVABLE	SAME AS K-841E, MOV.					332			1	K-851E
-	2	K-851F	CONTACT - STATIONARY	SAME AS K-841F, STA.					333			2	K-851F
-	1	K-851F	CONTACT - MOVABLE	SAME AS K-841F, MOV.					334			1	K-851F
-	2	K-851G	MAIN CONTACT SPRING	FOR RELAY K-851 - SAME AS K-841G					335			2	K-851G
-	1	K-851H	KNOCKOUT SPRING	FOR RELAY K-851 - SAME AS K-841H					336			1	K-851H
-	1	K-851J	SPRING	FOR RELAY K-851 - SAME AS K-841J					337			1	K-851J
-	1	K-851K	SPRING	FOR RELAY K-851 - SAME AS K-841K					338			1	K-851K
-	3	K-851L	SPRING	FOR RELAY K-851 - SAME AS K-841L					339			3	K-851L, K-852H, K-853H
-	2		INSULATION FOR K-851	ARC SHIELD - SAME AS ITEM #243					340			0	
-	2	K-852	RELAY	SAME AS K-842					341			0	K-852, K-853
0	2	K-852A	COIL	TWO WINDINGS - ONE 8000 TURNS #34 EN. CU. 980 OHMS RESIS. - SECOND WINDING 2100 TURNS #36 EN. CU. 500 OHMS RESIS.			1	S#1315391	342	37-J-890 P5		1	K-852A, K-853A
-	2	K-852B	MAIN CONTACT - STATIONARY	SAME AS K-842B, STA.					343			2	K-852B, K-853B
-	2	K-852B	MAIN CONTACT - MOVABLE	SAME AS K-842B, MOV.					344			2	K-852B, K-853B
-	4	K-852C	CONTACT - STATIONARY	SAME AS K-842C, STA.					345			4	K-852C, K-853C
-	2	K-852C	CONTACT - MOVABLE	SAME AS K-842C, MOV.					346			2	K-852C, K-853C
-	4	K-852D	CONTACT - STATIONARY	SAME AS K-842D, STA.					347			4	K-852D, K-853D

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
-	2	K-852D	CONTACT - MOVABLE	SAME AS K-842D, MOV.					348			2	K-852D, K-853D
-	2	K-852E	SPRING	FOR RELAY K-852 - SAME AS K-842E					349			2	K-852E, K-853E
-	2	K-852F	RETURN SPRING	FOR RELAY K-852 - SAME AS K-842F					350			2	K-852F, K-853F
-	2	K-852G	ARMATURE SPRING	SAME AS K-842G					351			2	K-852G, K-853G
-	X	K-852H	SPRING	FOR RELAY K-852 - SAME AS K-851L					352				
-	X	K-853	RELAY	SAME AS K-842					353				
0	X	K-853A	COIL	SAME AS K-852A					354				
-	X	K-853B	MAIN CONTACT - STATIONARY	SAME AS K-842B, STA.					355				
-	X	K-853B	MAIN CONTACT - MOVABLE	SAME AS K-842B, MOV.					356				
-	X	K-853C	CONTACT - STATIONARY	SAME AS K-842C, STA.					357				
-	X	K-853C	CONTACT - MOVABLE	SAME AS K-842C, MOV.					358				
-	X	K-853D	CONTACT - STATIONARY	SAME AS K-842D, STA.					359				
-	X	K-853D	CONTACT - MOVABLE	SAME AS K-842D, MOV.					360				
-	X	K-853E	SPRING	FOR RELAY K-853 - SAME AS K-852E					361				
-	X	K-853F	RETURN SPRING	FOR RELAY K-853 - SAME AS K-852F					362				
-	X	K-853G	ARMATURE SPRING	SAME AS K-852G					363				
-	X	K-853H	SPRING	FOR RELAY K-853 - SAME AS K-851L					364				
0	1	K-854	OVERLOAD RELAY	MI HEATER			1		365			0	K-854
0	1	K-854A	HEATER FOR K-854	26.0 AMPS			1	S#1265727	366	36-J-639 P22		1	K-854A
0	0	K-854B	OVERLOAD RELAY - LESS HEATER	MI			1		367			0	K-854B
1	1	L-1	COIL - M.O. TANK - INCLUDES S-1A,B, C-1,C-2,C-3,C-56 & C-61	15 TURNS OF 1/2" X 1/16" COPPER STRAP WOUND EDGEWISE 5 5/8" OUTSIDE DIAMETER COMPLETE WITH PLUNGER 20 MICROHENRIES			1		368	7810311 G1		0	L-1

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

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0	0		COIL - SPARE FOR L-1	DOES NOT INCLUDE S-1A, B & C, C-1, C-2, C-3, C-56, C-61			1	7810311 G2	369			0	
6	6		INSULATOR FOR L-1	ISOLANTITE 7 3/8 LG X 3/4 X 1/2	-61118		23	7806537 P1	370	7810311 P9		3	
1	1		END FOR L-1 (FRONT)	MICALEX 11 1/2 X 7 X 5/16 TK			1	7405446 P2	371	7810311 P55		0	
1	1		END FOR L-1 (REAR)	MICALEX 11 1/2 X 7 X 5/16 TK			1	7706375 P3	372	7810311 P4		0	
1	1		CONTACT FOR L-1 (SLIDING)	NICKEL SILVER 1 15/32 X 13/16 OF .020 TK			1	7405699 P3	373	7604992 P18		2	
1	1	L-2	COIL - M.O. FIL. CHOKE	TWO COAXIAL WINDINGS, BOTTOM WINDING 50 TURNS, TOP WINDING 48 1/2 TURNS 3.5 AMPS. A.C. OR D.C.			1		374	7707507 G5		0	L-2
0	0		COIL - SPARE FOR L-2				1	7705707 G1	375	7602282 P193		0	
1	1		COIL FORM FOR L-2	MICARTA TUBE 5 5/16 OF 3 O.D. X 2 5/8 I.D.			1	7705707 P3	376			0	
1	1	L-3	COIL - DOUBLER TANK	16 5/6 TURNS OF #10 TINNED COPPER WIRE, 5 AMPS. R.F., 10 MICROHENRIES	-47458		1		377	7705659 G5		0	L-3
1	1		COIL FORM FOR L-3	MICARTA TUBE 5 5/8 OF 3 O.D. X 2 3/4 I.D.			1	7404909 P1	378	7705659 P2		0	
6	6		INSULATOR FOR L-3	ISOLANTITE 3 3/8 X 1/2 X 1/2	-61130		23	7602239 P13	379	7705659 P4		3	
1	1	L-4	COIL - M.O. PLATE CHOKE	INDUCTANCE 4 MILLIHENRIES D.C. RESISTANCE 10 OHMS, 500 MILLIAMPS D.C.			9	TYPE R-152	380	7607282 P197		1	L-4
3	3	L-5	COIL 1ST INT. PLATE CHOKE	125 TURNS, INDUCTANCE 0.35 MILLIHENRIES ±5%, D.C. RESISTANCE 1.35 OHMS, TEST INDUCTANCE AT 1000 CYCLES 0.4 AMPS.	-47457		1		381	L-303483		1	L-5, L-17, L-18
5	5		INSULATOR FOR L-5, L-10, L-15, L-17, L-18	PRESTITE	-61423S		1	50-C-691 P1	382	7705781 P57		3	
5	5		INSULATOR FOR L-5, L-10, L-15, L-17, L-18	MOLDARTA	-61422S		1	7408574 P1	383	7705781 P58		3	
2	2	L-6	COIL - 1ST INT. GRID CHOKE	THREE SECTIONS, 20 TURNS EACH 1/4" BETWEEN EACH SECTION, #26 S.C.C.E. WIRE, 200 MILLIAMPS D.C.	-47465		1		384	7405204 G2		0	L-6, L-8

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0	0		COIL - SPARE FOR L-6,L-8	LESS MOUNTING BRACKET			1	7405204 G5	385	7607282 P200		0	
3	3		COIL FORM FOR L-6,L-8,L-11	ISOLANTITE			23	7803570 P1	386	7405204 P2		0	
1	1	L-7	COIL - 1ST INT. TANK	24 TURNS #14 TINNED COPPER WIRE. SPACE WOUND, 5 AMPS R.F.	-47450		1		387	7706592 G1		0	L-7
1	1		COIL FORM FOR L-7	ISOLANTITE			23	7705779 P2	388	7706592 P2		0	
X	X	L-8	COIL - 2ND INT. GRID CHOKE	SAME AS L-6	-47455				389				
0	0		COIL - SPARE FOR L-8	SAME AS L-6	-47455				390				
X	X		COIL FORM FOR L-8	SAME AS ITEM 386					391				
1	1	L-9	COIL - 2ND INT. TANK	ROTATING COIL, 22 MICROHENRIES, 14 TURNS 3/16" X 5/16" COPPER BAR, WOUND EDGEWISE 20 AMPS R.F.	-47451		1		392	7409127 G2		0	L-9
3	3		ROTOR FOR L-9,L-13,L-14				1	7609876 G1	393	7409127 P5		0	
18	18		INSULATOR FOR L-9,L-13,L-14 ROTOR	ISOLANTITE	-61462		23	7409157 P1	394	7609876 P2		4	
3	3		END FOR L-9,L-13,L-14 (FRONT)	MICALEX 8 X 7 3/4 X 3/8 TK			1	7404913 P2	395	7409127 P23		0	
3	3		END FOR L-9,L-13,L-14 (REAR)	MICALEX 8 X 7 3/4 X 3/8 TK			1	7407465 P1	396	7409127 P50		0	
3	3		CONTACT FOR L-9,L-13,L-14 (SLIDING)	SPRING & SHOE			1	7808667 G1	397	7405547 P5		2	
3	3		SPRING FOR L-9,L-13,L-14 (CONTACT)				1	7405680 P1	398	7405547 P6		3	
3	3		CONTACT BRUSH FOR L-9,L-13 L-14	3 PIECES			1	7403735 G1	399	7405547 P7		2	
12	12		SPRING FOR L-9,L-13,L-14				1	7409089 P1	400	7409127 P36		2	
12	12		SPRING FOR L-9,L-13,L-14				1	7409089 P2	401	7409127 P37		2	
12	12		SPRING BRUSH FOR L-9,L-13, L-14				1	7409089 P3	402	7409127 P38		2	
2	2	L-10	COIL - 2ND INT. PLATE CHOKE	375 TURNS, BASKET WOUND, INDUCTANCE 4 MILLIHENRIES ±5%, D.C. RESISTANCE 5.15 OHMS, TEST INDUCTANCE AT 1000 CYCLE 0.4 AMP. D.C.	-47452		1		403	L-303481		1	L-10,L-15

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X	X		INSULATOR FOR L-10	SAME AS ITEM 313	-61423S				404				
X	X		INSULATOR FOR L-10	SAME AS ITEM 314	-61422S				405				
1	1	L-11	COIL P.A. GRID CHOKE	FOUR SECTION, 5-10-10-5 TURNS 1/4" BETWEEN SECTIONS, #30 D.C.C. CU. WIRE 100 MILLIAMPS D.C.	-47454				406	7405204 G1		0	L-11
0	0		COIL - SPARE FOR L-11				1	7405204 G3	407	7607282 P207		0	
X	X		COIL FORM FOR L-11	SAME AS ITEM 386					408				
1	1	L-12	COIL - P.A. GRID CHOKE	65 TURNS, #24 D.C. EN. WIRE, INDUCTANCE 0.076 MILLIHENRIES MIN., 0.092 MILLIHENRIES MAX. RESISTANCE 0.62 OHM ±10% TEST INDUCTANCE AT 1000 CYCLES	-47453		1		409	L-365782		1	L-12
1	1		INSULATOR FOR L-12	ISOLANTITE 2 LG X 3/4 DIA.	-61061		23	7602239 P4	410	7604725 P4		1	
1	1	L-13	COIL - ANT. TUNING	ROTATING COIL, 22 MICROHENRIES, 14 TURNS, 3/16" X 5/16" COPPER BAR WOUND EDGEWISE, 20 AMPS. R.F.	-47482		1		411	7409127 G1		0	L-13
X	X		ROTOR FOR L-13	SAME AS ROTOR FOR L-9 ITEM 393					412				
X	X		INSULATOR FOR L-13 ROTOR	SAME AS ITEM 394	-61462				413				
X	X		END FOR L-13 (FRONT)	SAME AS ITEM 395					414				
X	X		END FOR L-13 (REAR)	SAME AS ITEM 396					415				
X	X		CONTACT FOR L-13 (SLIDING)	SAME AS ITEM 397					416				
X	X		SPRING FOR L-13 CONTACT	SAME AS ITEM 398					417				
X	X		CONTACT BRUSH FOR L-13	SAME AS ITEM 399					418				
X	X		SPRING FOR L-13	SAME AS ITEM 400					419				
X	X		SPRING FOR L-13	SAME AS ITEM 401					420				
X	X		SPRING BRUSH FOR L-13	SAME AS ITEM 402					421				
1	1	L-14	COIL - P.A. TANK	ROTATING COIL, 22 MICROHENRIES, 14 TURNS, 3/16" X 5/16" COPPER BAR WOUND EDGEWISE 20 AMPS. R.F.	-47481		1		422	7409127 G3		0	L-14

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X	X		ROTOR FOR L-14	SAME AS ROTOR FOR L-9, ITEM 393					423				
X	X		INSULATOR FOR L-14 ROTOR	SAME AS ITEM 394	-61462				424				
X	X		END FOR L-14 (FRONT)	SAME AS ITEM 395					425				
X	X		END FOR L-14 (REAR)	SAME AS ITEM 396					426				
X	X		CONTACT FOR L-14 (SLIDING)	SAME AS ITEM 397					427				
X	X		SPRING FOR L-14 CONTACT	SAME AS ITEM 398					428				
X	X		CONTACT BRUSH FOR L-14	SAME AS ITEM 399					429				
X	X		SPRING FOR L-14	SAME AS ITEM 400					430				
X	X		SPRING FOR L-14	SAME AS ITEM 401					431				
X	X		SPRING BRUSH FOR L-14	SAME AS ITEM 402					432				
2	2		GEARS FOR L-14	24 TEETH			25	7409127 P52	433	7409127 P52		0	L-14
1	1		GEAR FOR L-14	42 TEETH			25	7409127 P59	434	7409127 P59		0	L-14
X	X	L-15	COIL - P.A. PLATE CHOKE	SAME AS L-10	-47452				435				
X	X		INSULATOR FOR L-15	SAME AS ITEM 382	-61423S				436				
X	X		INSULATOR FOR L-15	SAME AS ITEM 383	-61422S				437				
1	1	L-16	COIL - THUMP FILTER CHOKE	1600 TURNS, INDUCT. AT 110 V., 60 CYCLE AND 0.5 AMP. D.C., 1 HENRY MIN. D.C. RESISTANCE 40.0 OHMS MAX., 30 OHMS MIN., 60 CYCLE IMPEDANCE, 377 OHMS MIN. TEST AT 1500 V.A.C.	-30185		1	7700950	438	7607282 P212		1	L-16
X	X	L-17	COIL - FILTER CHOKE	SAME AS L-5	-47457				439				
X	X		INSULATOR FOR L-17	SAME AS ITEM 382	-61423S				440				
X	X		INSULATOR FOR L-17	SAME AS ITEM 383	-61422S				441				
X	X	L-18	COIL - FILTER CHOKE	SAME AS L-5	-47457				442				
X	X		INSULATOR FOR L-18	SAME AS ITEM 382	-61423S				443				
X	X		INSULATOR FOR L-18	SAME AS ITEM 383	-61422S				444				

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1	1	L-19	COIL - P.A. GRID	5 TURNS #10 TINNED COPPER WIRE 7/8 " INSIDE DIAMETER	-47456		1		445	7406169 G1		0	L-19
3	3	L-401	REACTOR - MICROPHONE FILTER	210 TURNS INDUCTANCE .067 HENRY AT 4 V., 60 CYCLE, .066 AMP. D.C. RESISTANCE 0.35 OHM, D.C. ±15%, 60 CYCLE IMPEDANCE 25 OHMS, TEST 1500 V., 60 CYCLE. WIRE SIZE #15 B & S GAUGE	-30562		1	L-365747	446	7606286 P40		0	L-401, L-406, L-407
4	4		TERMINAL BOARD FOR L-401, L-406, L-407	MICARTA 2 7/8 X 1 X 1/8-7/16 LEG			1		447	7706433 P6		0	
1	1	L-402	REACTOR - VOICE RELAY FILTER	4400 TURNS INDUCTANCE 10 HENRIES AT 3 V., 60 CYCLE .020 AMP. D.C. RESISTANCE 625 OHMS D.C. ±15%, 60 CYCLE IMPEDANCE 3750 OHMS, TEST 1500 V. 60 CYCLE. WIRE SIZE #36 B & S GAUGE	-30566		1	L-365751	448	7606286 P41		1	L-402
1	1	L-403	CHOKE - TONE OSCILLATOR	2000 TURNS INDUCTANCE 1.6 HENRIES AT 5 V. 1000 CYCLE, 0 AMP. D.C. RESISTANCE 140 OHMS D.C. ±15%, 60 CYCLE IMPEDANCE 600 OHMS, TEST 1500 V., 60 CYCLE. WIRE SIZE #34 B & S GAUGE	-30567		1	L-365752	449	7606286 P42		1	L-403
1	1	L-404	REACTOR - MODULATION	3000 TURNS, INDUCTANCE 35 HENRIES AT 110 V. 60 CYCLE, .27 AMP. D.C. RESISTANCE 105 OHMS D.C. ±15%, 60 CYCLE IMPEDANCE 13,200 OHMS, TEST 10,000 V, 60 CY, #24 B&S GAUGE	-30559		1	L-365743 OR L-420198	450	7606286 P43		1	L-404
1	1	L-405	REACTOR - SCREEN GRID MODULATOR	3600 TURNS INDUCTANCE 30 HENRIES AT 1000 V., 60 CYCLE, .070 AMP. D.C. RESISTANCE 213 OHMS D.C. ±15% 60 CYCLE IMPEDANCE 11,300 OHMS, TEST 1500 V., 60 CYCLE. WIRE SIZE #29 B & S GAUGE	-30568		1	L-365753	451	7606286 P44		1	L-405
X	X		TERMINAL BOARD FOR L-405	SAME AS ITEM 49					452				
X	X	L-406	REACTOR - MICROPHONE FILTER	SAME AS L-401	-30562				453				
X	X		TERMINAL BOARD FOR L-406	SAME AS ITEM 49					454				
X	X	L-407	REACTOR - MICROPHONE FILTER	SAME AS L-401	-30562				455				
X	X		TERMINAL BOARD FOR L-407	SAME AS ITEM 49					456				
1	1	L-408	REACTOR - MOD GRID	500 TURNS, INDUCTANCE 16 MILLI-HENRIES AT 3 V , 60 CYCLE, .18 AMP D.C., RESISTANCE 11 OHMS D.C. ±15% 60 CYCLE IMPEDANCE, 23 OHMS, TEST 1500 V., 60 CYCLE WIRE SIZE #29	-30569		1	L-365754	456A	7606286 P47		1	L-408

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1	1	M-1	METER - ANTENNA CURRENT	0 TO 15 AMPS. R.F. WITH ANTI-GLARE GLASS	-22035	17-I-12	1		458	7605997 P15		0	M-1
1	1	M-2	METER - P.A. PLATE CURRENT	0 TO 500 MA D.C. WITH ANTI-GLARE GLASS	-22067	17-I-12	1		459	7605997 P1		0	M-2
3	3	M-3	METER - P.A. GRID CURRENT	0 TO 100 MA. D.C.WITH ANTI-GLARE GLASS	-22059	17-I-12	1		460	7605997 P16		0	M-3,M-5,M-7
5	5	M-4	METER - 2ND INT. PLATE CURRENT	0 TO 250 MA. D.C. WITH ANTI-GLARE GLASS	-22065	17-I-12	1		461	7605997 P4		0	M-4,M-6,M-402,M-403,M-404
X	X	M-5	METER - 2ND INT. GRID CURRENT	SAME AS M-3	-22059				462				
X	X	M-6	METER - 1ST INT. PLATE CURRENT	SAME AS M-4	-22065				463				
X	X	M-7	METER - M.O. PLATE CURRENT	SAME AS M-3	-22059				464				
1	1	M-8	METER - M.O. SCREEN CURRENT	0 TO 50 MA. D.C. WITH ANTI-GLARE GLASS	-22056	17-I-12	1		465	7605997 P17		0	M-8
1	1	M-9	METER - P.A. PLATE VOLTAGE	0 TO 3.5 KV., D.C., 1000 OHMS PER VOLT WITH EXTERNAL MULTIPLIER -63775 WITH ANTI-GLARE GLASS	-22311	17-I-12	1		466	7605997 P26		0	M-9
1	1	M-9R	MULTIPLIER FOR M-9		-63775				467	7607283 P232		1	M-9R
1	1	M-10	METER - P.A. TUBE LIFE	100,000 HOUR TOTAL TIME METER FOR 120 VOLTS, 60 CYCLE OPERATION, LOWEST CALIBRATION 1/10 HOUR CYCLOMETER TYPE WITH ANTI-GLARE GLASS	-22199C	17-I-12	1	S#1164055	468	7605997 P27		0	M-10
2	2	M-11	METER - FILAMENT VOLTAGE	0 TO 15 V.A.C. WITH ANTI-GLARE GLASS	-22080	17-I-12	1		469	7605997 P6		0	M-11,M-406
1	1	M-12	METER - BIAS VOLTAGE	0 TO 500 V.D.C. 1000 OHMS PER VOLT WITH INTERNAL MULTIPLIER WITH ANTI-GLARE GLASS	-22225	17-I-12	1		470	7605997 P21		0	M-12
1	1	M-401	AMMETER - 1ST AMP. PLATE	0 TO 30 MA., D.C. WITH ANTI-GLARE GLASS	-22318	17-I-12	1	7605997 P19	471	7606286 P51		0	M-401
X	X	M-402	AMMETER - 2ND AMP. PLATE	SAME AS M-4	-22065				472				
X	X	M-403	METER - MODULATOR PLATE	SAME AS M-4	-22065				473				
X	X	M-404	METER	SAME AS M-4	-22065				474				

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
1	1	M-405	METER - MODULATION	0 TO 100%, INCLUDES TRANSFORMER NAVY TYPE -30557 WITH ANTI-GLARE GLASS	-22229A		1	7605997 P20	475	7606286 P55		0	M-405
X	X	M-406	VOLTMETER - FILAMENT	SAME AS M-11	-22080				476			0	
2	2	O-213	BEARINGS FOR G-211				1	S#1196895	477	33-J-176 P103		2	O-213
3	3	O-214	BEARING PULLER PARTS FOR O-213,O-223,O-241,O-273	PLATES & BOLTS			1	97-C-683	478	33-J-185 P55		0	O-214,O-224,O-242,O-274
4	4	O-223	BEARING FOR G-221				1	S#1133077	479	33-J-178 P8		2	O-223,O-241,O-273
X	X	O-224	BEARING PULLER PARTS	SAME AS O-214					480				
-	X	O-241	BEARINGS FOR B-241	SAME AS O-223					481				
-	X	O-242	BEARING PULLER PARTS	SAME AS O-214					482				
X	-	O-273	BEARINGS FOR B-271	SAME AS O-223					483				
X	-	O-274	BEARING PULLER PARTS	SAME AS O-214					484				
1	1	R-1	RESISTOR - BIAS POT.	10,000 OHMS, STYLE "B", GRADE 1, CLASS 2, TAPPED 10 EQUAL VALUES	-63484E	RE13A372J	28		485	7607283 P242		1	R-1
1	1	R-2	RESISTOR - M.O. SCREEN	30,000 OHMS, STYLE "A", GRADE 1, CLASS 2	-63361E	RE13A372J	28		486	7607283 P243		1	R-2
1	1	R-3	RESISTOR - M.O. PLATE	5000 OHMS, STYLE"A", GRADE 1, CLASS 2	-63212E	RE13A372J	28		487	7607283 P244		1	R-3
2	2	R-4	RESISTOR - KEYING RELAY ARC SUPPRESSOR	5000 OHMS, STYLE "D", GRADE 1, CLASS 2	-63085E	RE13A372J	28		488	7607283 P245		1	R-4,R-17
		R-5	NOT USED										
1	1	R-6	RESISTOR - FIL. RHEOSTAT	TWO 4" PLATES, 20 OHMS PER PLATE, EQUAL RESISTANCE STEPS, STAGGERED CONTACTS (SPECIAL)	-632386		10		489	7705853 P3		0	R-6
0	1	R-7	RESISTOR - BLOWER MOTOR SERIES	450 OHMS, STYLE D, GRADE 1, CLASS 2	-63069E	RE13A372	28		490	7705853 P3		1	R-7
5	5	R-8	RESISTOR - 1ST. INT. SCREEN	5000 OHMS, STYLE B, GRADE 1, CLASS 2	-63149E	RE13A372J	28		491	7607283 P249		3	R-8,R-10,R-18,R-23,R-25

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 V 50	TOTAL USED PER EQUIP. 230 V 50	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
		R-9	NOT USED										
X	X	R-10	RESISTOR - 2ND INT. SCREEN	SAME AS R-8	-63149E				492				
1	1	R-11	RESISTOR - LOW POWER FIL.	50 OHMS, STYLE B, GRADE 1, CLASS 2, TAPPED TEN EQUAL VALUES	-63224E	RE13A372J	28		493	7607283 P252		1	R-11
1	1	R-12	RESISTOR - P.A. SCREEN	1000 OHMS, STYLE B, GRADE 1, CLASS 2	-63141E	RE13A372J	28		494	7607283 P253		1	R-12
4	4	R-13	RESISTOR - LOW VOLTAGE FIELD	1000 OHMS ±10%, STYLE B, GRADE 1, CLASS 2, TAPPED 10 EQUAL VALUES	-63257E	RE13A372J	28		495	7607283 P254		2	R-13,R-419,R-420,R-421
2	2	R-14	RESISTOR - 2ND INT. TANK CAP. SHUNT	1 MEGOHM ±5%, 2 WATTS, COMPOSITION	-63426	RE13A372Q	11		496	7607283 P255		1	R-14,R-20
1	1	R-15	RESISTOR - H.V POTENTIOMETER	3000 OHMS, STYLE A, GRADE 1, CLASS 2, TAPPED TEN EQUAL VALUES	-63236E	RE13A372J	28		497	7607283 P256		1	R-15
1	1	R-16	RESISTOR - H.V POTENTIOMETER	1500 OHMS, STYLE A, GRADE 1, CLASS 2, TAPPED TEN EQUAL VALUES	-63233E	RE13A372J	28		498	7607283 P257		1	R-16
X	X	R-17	RESISTOR - COMP. RELAY SERIES	SAME AS R-4	-63085E				499				
X	X	R-18	RESISTOR - TUNING	SAME AS R-8	-63149E				500				
3	3	R-19	RESISTOR - BIAS POT.	500 OHMS, STYLE B, GRADE 1, CLASS 2, TAPPED TEN EQUAL VALUES	-63227E	RE13A372J	28		501	7607283 P260		2	R-19,R-21,R-28
X	X	R-20	RESISTOR - P.A. TANK CAPACITY SHUNTING	SAME AS R-14	-63426				502				
X	X	R-21	RESISTOR - BIAS POT.	SAME AS R-19	-63227E				503				
1	1	R-22	RESISTOR - P.A. GRID CHOKE SHUNTING	50,000 OHMS, STYLE D, GRADE 1, CLASS 2	-63097E	RE13A372J	28		504	7607283 P263		1	R-22
X	X	R-23	RESISTOR - P.A. GRID	SAME AS R-8	-63149E				505				
1	1	R-24	RESISTOR - 2ND INT. GRID	20,000 OHMS, STYLE B, GRADE 1, CLASS 2	-63159E	RE13A372J	28		506	7607283 P265		1	R-24
X	X	R-25	RESISTOR - 1ST INT. GRID	SAME AS R-8	-63149E				507				
1	1	R-26	RESISTOR - M.O. HEATER	TWO SECTIONS - 118 OHMS/SEC.			1		508	7604990 G7		0	R-26

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
		R-27	NOT USED										
X	X	R-28	RESISTOR - BIAS POT.	SAME AS R-19	-63227E				509				
0	2	R-29	RESISTOR - KEYING POT.	600 OHMS, GRADE 1, CLASS 2	-63071E	RE13A372	28		510	7810310 P80		1	R-29,R-32
1	1	R-30	RESISTOR - KEYING CIRCUIT SERIES	400 OHMS, STYLE D, GRADE 1, CLASS 2	-63067E	RE13A372J	28		511	7607283 P271		1	R-30
		R-31	NOT USED										
0	X	R-32	RESISTOR - FIELD CONT. SERIES	SAME AS R-29	-63071E				512				
1	1	R-33	RESISTOR - GEN. FIELD RHEO.	THREE 4" PLATES, TOTAL RESISTANCE 3200 OHMS, TAPERED TAPS, RESISTANCE DECREASED WITH CLOCKWISE ROTATION STAGGERED CONTACTS 0.075 TO 0.62 AMP. (SPECIAL)	-632378		1.0	7707741 P1	513	7607283 P274		0	R-33
0	1	R-34	RESISTOR - STARTING CONT. SERIES	1150 OHMS, STYLE D, GRADE 1, CLASS 2	-63733E	RE13A372	28		514	7607283 P275		1	R-34
1	0	R-35	RESISTOR - STARTING CONT. SERIES	375 OHMS, STYLE D, GRADE 1, CLASS 2	-63732E	RE13A372	28		515	7607283 P276		1	R-35
0	1	R-36	RESISTOR - KEYING POT.	1200 OHMS	-63077E				516	7607283 P277		1	R-36
		R-37 TO R-44	NOT USED										
4	4	R-45	RESISTOR - H.V POTENTIOMETER	1500 OHMS, STYLE A, GRADE 1, CLASS 2	-63204E	RE13A372J	28		517	7607283 P281		2	R-45,R-46,R-47,R-48
X	X	R-46	RESISTOR - H.V POTENTIOMETER	SAME AS R-45	-63204E				518				
X	X	R-47	RESISTOR - H.V POTENTIOMETER	SAME AS R-45	-63204E				519				
X	X	R-48	RESISTOR -H.V. POTENTIOMETER	SAME AS R-45	-63204E				520				
0	1	R-49	RESISTOR - HEATER CONTROL	1 OHMS, 3 WATTS, COMPOSITION	-63288	RE13A372G	12	TYPE D3-3	521	7607283 P285		1	R-49
1	1	R-50	RESISTOR - THERMOSTAT SPARK SUPPRESSOR	30,000 OHMS, 1 WATT, COMPOSITION	-63288	RE13A372G	12	TYPE C1-1	522	7607283 P286		1	R-50
		R-51 TO R-55	NOT USED										

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
1	0	R-56	RESISTOR - THERMOSTAT RELAY	2000 OHMS, STYLE D, GRADE 1, CLASS 2	-63553E	RE13A372	28		523	7607284 P292		1	R-56
0	1	R-57	RESISTOR - THERMOSTAT RELAY	8000 OHMS, STYLE D, GRADE 1, CLASS 2	-63506E	RE13A372	28		524	7607284 P293		1	R-57
1	0	R-58	RESISTOR - HEATER CONTROL				1	7705763 G4	525	7607284 P294		1	R-58
1	1	R-401	ATTENUATOR	600 OHMS, TOTAL ATTENUATION 30 DB IN 1.5 DB STEPS			31	T-323G T-405-A	526	7707250 P1		1	R-401
2	2	R-402	RESISTOR - LOADING	120,000 OHMS, 1 WATT, COMPOSITION	-63288	RE13A372G	32	TYPE BT-1	527	7606286 P60		1	R-402,R-403
X	X	R-403	RESISTOR	SAME AS R-402	-63288				528				
1	1	R-404	RESISTOR - GRID	25,000 OHMS, 1 WATT, COMPOSITION	-63288	RE13A372G	32	TYPE BT-1	529	7606286 P62		1	R-404
1	1	R-405	RESISTOR - DIODE FILTER	50,000 OHMS, 1 WATT, COMPOSITION	-63288	RE13A372G	32	TYPE BT-1	530	7606286 P63		1	R-405
1	1	R-406	RESISTOR - DIODE LOADING	2 MEGOHMS, 1 WATT, COMPOSITION	-63288	RE13A372G	32	TYPE BT-1	531	7606286 P64		1	R-406
2	2	R-407	RESISTOR - GRID LOADING	100,000 OHMS, 1 WATT, COMPOSITION	-63288	RE13A372G	32	TYPE BT-1	532	7606286 P65		1	R-407,R-408
X	X	R-408	RESISTOR	SAME AS R-407	-63288				533				
2	2	R-409	POTENTIOMETER - VOL. CONTROL	10,000 OHMS	-63844		32	TYPE CS	534	7706954 P10		1	R-409,R-432
2	2	R-410	RESISTOR - MODULATOR GRID	1500 OHMS, 20 WATTS, STYLE"E", GRADE 1, CLASS 2	-63545E	RE13A372J	28	7605861 P37	535	7606286 P68		1	R-410,R-411
X	X	R-411	RESISTOR	SAME AS R-410	-63545E				536				
1	1	R-412	RESISTOR - VOICE RELAY GRID	5 MEGOHMS, 1 WATT, COMPOSITION	-63288	RE13A372G	32	TYPE BT-1	537	7606286 P70		1	R-412
1	1	R-413	RHEOSTAT - VOICE RELAY	7000 OHMS, 2 WATTS	-632335-10		39	7407931 P5	538	7606287 P120		1	R-413
1	1	R-414	RESISTOR	100 OHMS, 100 WATTS, 10 TAPS, STYLE "B", GRADE 1, CLASS 2	-63225E	RE13A372J	28		539	7606286 P72		1	R-414
1	1	R-415	RHEOSTAT - FILAMENT	16 OHMS, 150 WATTS			10	7707250 P4	540	7606287 P73		0	R-415
1	1	R-416	RESISTOR - VOLTAGE REDUCTION	1250 OHMS, 200 WATTS, STYLE A, GRADE 1, CLASS 2	-63813E	RE13A372J	28	7605861 P38	541	7606287 P74		1	R-416
3	3		INSULATOR FOR R-416,R-422	ISOLANTITE 2 X 3/4 SQUARE	-61106		23	7705360 P13	542	7606294 P10		2	
2	2	R-417	RESISTOR	150 OHMS, 10 WATTS, STYLE "F", GRADE 1, CLASS 2	-63814E	RE13A372J	28	7605861 P41	543	7606287 P75		1	R-417,R-427
2	2		SUPPORT FOR R-417,R-427	MICARTA 2 15/16 X 1 X 1/2			1	7707470 P5	544	7606293 P35		0	

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

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2	2	R-418	RESISTOR - SCREEN GRID	10,000 OHMS, 1 WATT, COMPOSITION	-63288	RE13A372G	32	TYPE BT-1	545	7606287 P76		1	R-418,R-425
X	X	R-419	RESISTOR - BLEEDER	SAME AS R-13	-63257E				546				
X	X	R-420	RESISTOR	SAME AS R-13	-63257E				547				
X	X	R-421	RESISTOR	SAME AS R-13	-63257E				548				
1	1	R-422	RESISTOR - SURGE	100 OHMS, 100 WATTS, STYLE "B" GRADE 1, CLASS 2	-63124E	RE13A372J	28		549	7606287 P80		1	R-422
X	X		INSULATOR FOR R-422	SAME AS ITEM 82	-61106				550				
		R-423	NOT USED										
		R-424	NOT USED										
X	X	R-425	RESISTOR	SAME AS R-418	-63288				551				
1	1	R-426	RESISTOR	3000 OHMS, 1 WATT, COMPOSITION	-63288	RE13A372G	32		552	7606287 P84		1	R-426
1	1		SUPPORT FOR R-426	MICARTA 3 1/2 X 3 1/2 X 1/4			1	7407603	553	7407603 G1		0	
X	X	R-427	RESISTOR	SAME AS R-417	-63814E				554				
X	X		SUPPORT FOR R-427	SAME AS ITEM 84					555				
		R-428	NOT USED										
1	1	R-429	ATTENUATOR	600 OHMS, TOTAL TAPERED RANGE FROM 1 1/2 DB TO 128 DB ON LAST CONT.			31	T-330-G T-405-B	556	7707250 P2		1	R-429
		R-430	NOT USED										
		R-431	NOT USED										
X	X	R-432	POTENTIOMETER - A.V.C.	SAME AS R-409	-63844				557				
1	1	R-433	RESISTOR - O.L. RELAY SHUNT	25 OHMS, 10 WATTS, STYLE F, GRADE 1, CLASS 2	-63349E	RE13A372J	28	7602661 P298	558	7606287 P92		1	R-433
1	1		SUPPORT FOR R-433	MICARTA 6 7/8 X 1 X 1/2			1	7707470 P4	559	7606292 P128		0	
		R-434	NOT USED										
2	2	R-435	RESISTOR - INDICATOR LIGHT SERIES	1500 OHMS, 60 WATTS, STYLE "D", GRADE 1, CLASS 1	-63078F	RE13A372J	33		560	7606287 P81		1	R-435,R-436
X	X	R-436	RESISTOR - INDICATOR LIGHT SERIES	SAME AS R-435	-63078F				561				

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

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2	2	R-837	RESISTOR - PEAK LIMITER	THYRITE DISC 3" O.D. X 1.37 I.D. X 0.78 TK.	-632336		34		561A	7417504 P1		2	R-437,R-438
X	X	R-438	RESISTOR - PEAK LIMITER	SAME AS R-437	-632336				561B				
1	0	R-841	STARTING RESISTOR		-632411-10		1	S#1312904	562	45-J-406 P9		1	R-841
		R-842	NOT USED										
1	-	R-843	POTENTIOMETER				1	S#884241	563	45-J-406 P8		1	R-843
		R-844 TO R-850	NOT USED										
0	1	R-851	STARTING RESISTOR		-632410-10		1	S#1312911	564			1	R-851
		R-852	NOT USED										
-	1	R-853	POTENTIOMETER	SAME AS R-843					565			1	
1	1	RX-401	RECTOX - MICROPHONE SUPPLY	1.35 MAX. AMPS. - 12.8 VOLTS, APPLY ONE COAT OF VARNISH & CADMIUM PLATE ALL CONNECTORS FOR NAVAL SERVICE			1	S#1186496	566	7707252 P2		1	RX-401
2	2	RX-402	RECTOX - SURGE LIMITING	.1 MAX. AMPS. - 12.8 VOLTS, APPLY TWO COATS OF VARNISH, TERMINALS TO BE PLATED WITH TIN, CADMIUM OR NICKEL			1	S#1190435	567	7606287 P134		1	RX-402,RX-403
X	X	RX-403	RECTOX - SURGE LIMITING	SAME AS RX-402					568				
1	1	S-1A	SWITCH - M.O. RANGE	PART OF L-1			1		569	7607284 P299		0	S-1A
16	16		CONTACT FOR S-1A & S-1B				1	7705733 P8	570	7810311 P40		4	
2	2		ARM FOR S-1A & S-1B				1	7705733 G2	571	7810311 P41		2	
1	1		PLATE FOR S-1A	MICALEX 4 X 3 3/8 X 1/4 TK			1	7706375 P2	572	7810311 P31		0	
1	1	S-1B	SWITCH - M.O. RANGE	PART OF L-1			1		573	7607284 P300		0	
X	X		CONTACT FOR S-1B	SAME AS ITEM 570					574				
X	X		ARM FOR S-1B	SAME AS ITEM 571					575				

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
1	1	S-1C	INTERLOCK - M.O. RANGE	S.P.S.T. NORMALLY CLOSED			1		576	7607284 P301		1	S-1C
1	1	S-2A	INTERLOCK - P.A. RANGE	S.P.S.T., ONE BREAK PER CIRCUIT, 0.2 AMP., 220 V.D.C., INTERLOCK TYPE			1		577	7705078 G2		1	S-2A
1	1	S-2B	SWITCH - P.A. RANGE	MOUNTED ON L-14			1	7708170 G1	578	7409127 P60		1	S-2B
1	1	S-2C	SWITCH - P.A. RANGE GRID	S.P.S.T., ONE BREAK PER CIRCUIT, KNIFE SWITCH TYPE			1		579	7406186 G6		1	S-2C
1	1		PLATE FOR S-2C	MICALEX 3 X 2 1/4 OF 1/4 TK			1	7406186 P16	580	7406186 P16		1	
1	1	S-2D	SWITCH - 2ND INT. RANGE	MOUNTED ON L-9			1	7708170 G2	581	7409127 P46		1	S-2D
1	1	S-2E	SWITCH - 1ST INT. RANGE	S.P.S.T., ONE BREAK PER CIRCUIT, KNIFE SWITCH TYPE			1		582	7605006 G9		1	S-2E
2	2		INSULATOR FOR S-2E	ISOLANTITE 1 X 1/2 DIA.	-61232		23	7602239 P64	583	7605006 P11		1	
3	3	S-3A	SWITCH - FIL. COMPENSATION	S.P., TWO POSITIONS, ONE BREAK PER CIRCUIT, 10 AMPS., 125 VOLTS, TOGGLE TYPE	-24095A		13		584	7706780 P1		1	S-3A, S-3B, S-3C
X	X	S-3B	SWITCH - P.A. FILAMENT	SAME AS S-3A	-24095A				585				
X	X	S-3C	SWITCH - TUBE LIFE METER	SAME AS S-3A	-24095A				586				
1	1	S-4A	SWITCH - P.A. GRID (HI-LO)	D.P.D.T., ONE BREAK PER CIRCUIT, 10 AMPS. R.F., 3000 VOLTS, ROTARY TYPE			1		587	7613489 G1		0	S-4A, S-4B
X	X	S-4B	HIGH-LOW POWER INTERMEDIATE AMPLIFIER ANTENNA TRANSFER SWITCH	PART OF S-4A					588	7607284 P311		0	
1	1		PLATE FOR S-4A & S-4B	MICARTA 7 1/2 X 3 3/16 X 1/4 TK			1	7415416 G2	589	7713515 P5		0	
1	1		INSULATOR FOR S-4A & S-4B	MICALEX 2 3/4 X 1 3/4 X 1/4 TK			1	7806466 P1	590	7713488 P4		0	
2	2		INSULATOR FOR S-4A, S-4B, S-5A, B, C,	ISOLANTITE 1 LG X 1 3/4 DIA.	-61033		23	7705360 P2	591	7713488 P3		1	
X	X		INSULATOR FOR S-4A & S-4B	SAME AS ITEM 39					592				
4	4		BRUSH FOR S-4A, S-4B, S-9	NICKEL SILVER			1	7708696 P4	593	7713488 P5		1	
4	4		BRUSH FOR S-4A, S-4B, S-9	NICKEL SILVER			1	7708696 P5	594	7713488 P6		1	

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
4	4		BRUSH FOR S-4A, S-4B, S-9	NICKEL SILVER			1	7708696 P6	595	7713488 P7		1	
15	15		CONTACTS FOR S-4A,S-4B, S-5A,B,C,	BRASS 1/2 OF 7/16 HEX. #8-32 THREAD			1	7805141 P2	596	7613489 P11		4	
1	1	S-5A	SWITCH - ANTENNA TRANSFER HIGH-LOW POWER	THREE POLE, D.T., ONE BREAK PER CIRCUIT. 10 AMPS., R.F. OR D.C. 3000 VOLTS, ROTARY TYPE			1		597	7613331 G1		0	S-5A,S-5B,S-5C
X	X	S-5B	SWITCH - P.A. SCREEN GRID, HIGH-LOW POWER	PART OF S-5A					598	7607284 P313			
X	X	S-5C	SWITCH - HIGH-LOW POWER P.A. PLATE SWITCH	PART OF S-5A					599	7607284 P314			
1	1		PANEL FOR S-5A,B,C	MICARTA 7 1/2 X 7 X 1/4 TK.			1	7415415 P1	600	7713515 P2		0	
1	1		INSULATOR FOR S-5A,B,C	ISOLANTITE 3 5/8 DIA. X 3/8 TK	-61219		23	7806456 P1	601	7713467 P4		1	
X	X		INSULATOR FOR S-5A,B,C	SAME AS ITEM 591	-61033				602				
X	X		INSULATOR FOR S-5A,B,C	SAME AS ITEM 54	-61084				603				
3	3		BRUSH FOR S-5A,B,C	NICKEL SILVER			1	7708696 P1	604	7713487 P5		1	
3	3		BRUSH FOR S-5A,B,C	NICKEL SILVER			1	7708696 P2	605	7713487 P6		1	
3	3		BRUSH FOR S-5A,B,C	NICKEL SILVER			1	7708696 P3	606	7713487 P7		1	
X	X		CONTACT FOR S-5A,B,C	SAME AS ITEM 596					607				
1	1		SPRING FOR S-5A,B,C	PHOS. BRONZE 3/8 DIA.			1	7809803 P1	608	7613331 P7		0	
1	1	S-6	SWITCH - ANTENNA CURRENT VOLTAGE FEED	D.P.D.T., ONE BREAK PER CIRCUIT, 20 AMPS. R.F., 3000 VOLTS, ROTARY TYPE			1		609	7613686 G1		0	S-6
1	1		PANEL FOR S-6	MICARTA 9 1/4 X 4 1/2 X 1/4 TK			1	7415896 P1	610	7713515 G6		0	
X	X		INSULATOR FOR S-6	SAME AS ITEM 94	-61029				611				
4	4		INSULATOR FOR S-6	ISOLANTITE	-61061		23	7602239 P4	612	7613686 P15		2	
2	2		BRUSH FOR S-6	NICKEL SILVER			1	7602913 P2	613	7613686 P17		1	
2	2		BRUSH FOR S-6	NICKEL SILVER			1	7602913 P3	614	7613686 P18		1	

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
2	2		BRUSH FOR S-6	NICKEL SILVER			1	7602913 P4	615	7613686 P19		1	
6	6		CONTACT FOR S-6	BRASS 11/16 X 7/8 HEX. #10-32 THREAD			1	7805141 P5	616	7613686 P24		2	
1	1		SPRING FOR S-6	PHOS. BRONZE 3/8 DIA.			19	7807511 P4	617	7613686 P9		0	
2	2	S-7	SWITCH - REMOTE LOCAL	FOUR POLE D.T., ONE BREAK PER CIRCUIT 2 AMPS., 220 VOLTS, TOGGLE TYPE	-24086		14 18		618	7707082 P2		2	S-7,S-403
1	1	S-8	SWITCH - 4 WIRE START-STOP	D.P.S.T., 10 AMPS. AT 250 V.A.C. PUSH BUTTON TYPE			1		619	7707242 G4		0	S-8
0	0		SWITCH - 4 WIRE START-STOP	SPARE FOR S-8					620	7707242 G10		1	
1	1	S-9	SWITCH - ADJUST - TUNE OPERATE WITH INTERLOCK	D.P. TRIPLE THROW, ONE BREAK EACH IN TWO CIRCUITS, 3 AMPS., 3000 VOLTS D.C. ROTARY TYPE, INTERLOCK SAME AS S-1C					621	7613707 G2		0	S-9
1	1		PANEL FOR S-9	MICARTA 8 X 5 1/4 X 1/4 TK			1	7416048 P1	622	7713515 G9		0	
1	1		INSULATOR FOR S-9	ISOLANTITE 1 1/8 X 1 3/4 DIA.	-61478		1	7705360 P25	623	7713488 P17		1	
1	1		ARM FOR S-9	MICALEX 2 3/4 X 1 3/4 X 1/4 TK			1	7806466 P1	624	7713488 P4		0	
8	8		INSULATOR FOR S-9	ISOLANTITE	-61028		1	7602239 P1	625	7615707 P24		4	
8	8		CONTACT FOR S-9	BRASS 3/8 OF 7/16 HEX., #6-32 THREAD			1	7805141 P6	626	7613707 P26		2	
X	X		CONTACT FOR S-9	SAME AS ITEM 593					627				
X	X		CONTACT FOR S-9	SAME AS ITEM 594					628				
X	X		CONTACT FOR S-9	SAME AS ITEM 595					629				
1	1	S-9A	INTERLOCK FOR S-9	S.P.S.T. NORMALLY CLOSED, PART OF S-9			1	7412580 G1	630	7613707 P31		1	S-9A
1	1		SPRING FOR S-9	PHOS. BRONZE 3/8 DIA.			19	7817511 P8	631	7613707 P35		0	
1	1	S-10	SWITCH - TEST KEY	D.P.D.T., OPEN NEUTRAL AND NON-LOCK 10 AMPS. A.C., 2 AMPS. D.C. AT 110 VOLTS, TOGGLE TYPE	-24069A		14 18		632	7707082 P1		1	S-10

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

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1	1	S-11	SWITCH - TEMPERATURE PROTECTION	S.P.S.T., TWO BREAKS PER CIRCUIT SPENCER DISC.OPEN 69°C TO 70°C CLOSE AT 55°C TO 60°C, 3.0 AMPS. AT 330 VOLTS D.C. OR 2.5 AMPS. AT 220 VOLTS, 60 CYCLE	-40034		1	S#1022783	633	7406282 P1		1	S-11
1	1	S-12	SWITCH - EMERGENCY STOP	D.P.D.T., TWO BREAKS PER CIRCUIT 30 AMPS., 250 VOLTS, TUMBLER TYPE	-24072		13		634	7706780 P2		1	S-12
1	1	S-13	SWITCH - THERMOSTAT	60°C., PLATINUM CONTACTS SET WITHIN 0.05°C, SINGLE CIRCUIT, DOUBLE BREAK, ANGLE TYPE	-40010	RE13A486C	15		635	7603330 P32		1	S-13
5	5	S-14	SWITCH - DOOR INTERLOCK	SINGLE CIRCUIT, DOUBLE BREAK, 1 AMP., 500 V., INTERLOCK TYPE	-24067		1	S#867378	636	7607284 P324		2	S-14,S-15,S-16,S-406,S-407
X	X	S-15	SWITCH - DOOR INTERLOCK	SAME AS -S-14	-24067				637				
X	X	S-16	SWITCH - DOOR INTERLOCK	SAME AS S-14	-24067				638				
1	1	S-17	SWITCH - 6 WIRE START-STOP	TWO BUTTON, MOMENTARY, 10 AMPS., 250 V.A.C., PUSH BUTTON TYPE			1	0908	639	7707242 G3		0	S-17
0	0		SWITCH - 6 WIRE START-STOP	SPARE FOR S-17					640	7707242 G-9		1	
1	1	S-401	HANDSET CRADLE SWITCH	4 P.D.T., 1 BREAK PER CIRCUIT			35		641	7407454 P1		1	S-401
1	1	S-402	SWITCH - AUTOMATIC MANUAL	S.P.D.T., 1 BREAK PER CIRCUIT, 3 WAY TOGGLE TYPE			6	3953 BLA	642	7407457 P1		1	S-402
X	X	S-403	SWITCH - CARRIER CONTROL SELECTOR	SAME AS S-7	-24086				643				
1	1	S-404	SWITCH TALK	LOCKING & NON-LOCKING, TOGGLE TYPE	-24085		14 18	7707082 P3	644	7606287 P96		1	S-404
1	1	S-405	SWITCH - CW MCW VOICE	MULTI-CONTACT 3 POS. 2 BREAKS PER CIRCUIT, ROTARY TYPE			1	7607518 G1	645	7606287 P100		0	S-405
1	1		SPRING FOR S-405				1	7808632 P1	646	7607518 P12		0	
15	15		CONTACT FOR S-405	BRASS CONTACT 1" OF .312 DIA.			1		647	7607518 P5		4	
15	15		CONTACT FOR S-405	CONTACT 1" OF .375 DIA.			1		648	7607518 P32		4	
10	10		CONTACT FOR S-405	SPRING CONTACT 2 27/64 X 0.020 TK			1		649	7607517 P5		3	

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X	X	S-406	INTERLOCK - DOOR	SAME AS S-14	-24067				650				
X	X	S-407	INTERLOCK - DOOR	SAME AS S-14	-24067				651				
3	3	S-408	SWITCH - ATTENUATOR RELAY POWER	SWITCH LINK 1 1/2 LG X 1/4 X 1/16 TK			1	7705385 P19	652	7707223 P3		0	S-408, S-409, S-410
X	X	S-409	SWITCH - ATTENUATOR RELAY POWER	SAME AS S-408					653				
X	X	S-410	SWITCH - REMOTE MICROPHONE POWER	SAME AS S-408					654				
1	1	S-411	SWITCH - AUTOMATIC SHUTDOWN	S.P.T.T., ONE BREAK PER CIRCUIT, 3 WAY, TOGGLE TYPE	-24371		14 18		655	7707082 P14		1	S-411
1	1	TH-1	THERMOMETER - M.O. TEMP.	CALIBRATED 30°C TO 70°C, STEM 7" X 1/2" ANGLE TYPE	-40025		15		656	7603258 P28		1	TH-1
1	1	T-1	TRANSFORMER - FILAMENT	0.211 KVA., 60 CYCLE WDG. TAPS VOLTS AMPS TURNS OHMS P1 4TO6 100 1.18 113 1.2 P1 5TO6 70 1.70 79 1.0 P2 1TO3 100 1.18 113 1.2 P2 1TO2 70 1.70 79 1.0 S1 7TO8 6.7 10 7 .018 S1 8TO9 11.4 10 13.5 .032 S2 13TO14 5 6.5 6 .025 S2 13TO15 10 6.5 12 .05 S3 10TO11 5.5 3.25 6.5 .04 S3 10TO12 11 3.25 13 .08 TEST 2500 VOLTS	-30302		1		657	L-317196		1	T-1
		T-2	NOT USED										
1	1	T-3	TRANSFORMER - COMPENSATOR	1.2 WATTS, 60 CYCLE PRIMARY 100 V., .012 AMP., 4180 TURNS, 675 OHMS SECONDARY 0.125 V., 10 AMPS., 10 TURNS, .009 OHM TEST 1500 VOLTS	-47465		1		658	L-332701		1	T-3
1	1	T-401	TRANSFORMER - MICROPHONE	100 TO 5000 CYCLE WDG. TAPS VOLTS TURNS OHMS PRI 1TO2 1.0 400 5.0 SEC 3TO4 3.2 1280 62 TEST 1200 VOLTS	-30563		1	L-365748	659	7606287 P102		1	T-401

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

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1	1	T-402	TRANSFORMER - LINE INPUT	100 TO 5000 CYCLE WDG. TAPS VOLTS TURNS OHMS P1 5T06 0.31 250 10 4T06 0.19 150 8 S1 1T02 5 4000 1330 S2 2T03 5 4000 2000 TEST 1500 VOLTS	-30565		1	L-365750	660	7606287 P103		1	T-402
1	1	T-403	TRANSFORMER - INTERSTAGE	100 TO 5000 CYCLE WDG. TAPS VOLTS TURNS OHMS P1 1T02 9 2000 1350 P2 2T03 9 2000 1350 S1 7T08 5.5 1160 105 S2 S3 5T06 14 3000 2500 S4 4T05 14 3000 2500 TEST 1500 VOLTS	-30564		1	L-365749	661	7606287 P104		1	T-403
1	1	T-404	TRANSFORMER - DRIVER	10 VA., 100 TO 5000 CYCLE WDG. TAPS VOLTS TURNS OHMS P1 1T02 127 750 50.5 P2 2T03 127 750 50.5 S1 9T010 63 375 25.3 10T011 64 375 25.3 S2 6T07 38 220 15.0 7T08 37 220 14.8 S3 4T05 10 60 4.1 TEST 1500 VOLTS	-30560		1	L-365744	662	7606287 P105		1	T-404
1	1	T-405	TRANSFORMER -MODULATION	400 VA., 100 TO 5000 CYCLE WDG. TAPS VOLTS AMPS TURNS OHMS P1,2 1T02 1130 0.35 800 40 P2,3 3T04 1130 0.35 800 50 S1,2 5T06 243 0.21 181 10 S1,2 6T07 28 0.21 21 1 S1,2 7T08 1640 0.21 1218 69 TEST 6000 VOLTS	-30558		1	L-365742 OR L-420197	663	7606287 P106		0	T-405
6	6		INSULATOR FOR T-405	2 PIECES, MALE -61287, FEMALE -61288	-61287 -61288		36	#1174	664	7707210 P9		3	
2	2		SPACER FOR T-405	PRESTITE	-61123S		1	50-C-695 P1	665	7702097 P43		1	
1	1		BUSHING FOR T-405	PRESTITE	-61141S		1	1-C-9300 P1	666	7702097 P44		1	
1	1	T-406	TRANSFORMER - MOD. METER	100 TO 5000 CYCLE WDG. TAPS AMPS TURNS OHMS PRI 1T02 0.21 120 1.2 S1 3T02 0.0045 2800 1450 S2 2T04 0.0045 2800 2000 INDUCTANCE 22 MILLIAMPS MAX.	-30557		1	L-365741	667	7606287 P107		1	T-406

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

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3	3		INSULATOR FOR T-406	ISOLANTITE - TAPERED 1 TO 1/2 X 1 LEG	-61028		23	7602239 P1	668			2	
1	1	T-407	TRANSFORMER - VOICE RELAY	RATIO - 10 TO 1, 100 TO 3000 CYCLE WDG. TAPS VOLTS TURNS OHMS P1 1T02 5 900 35 S1 3T04 50 9150 5000 TEST 1500 VOLTS	-30570		1	L-365779	669	7606287 P108		1	T-407
1	1	T-408	TRANSFORMER - FILAMENT	172 VA., 60 CYCLE WDG. TAPS VOLTS AMPS TURNS OHMS P1 4T05 30 1.0 33 0.6 5T06 70 1.0 79 1.4 P2 1T02 70 1.0 78 1.6 2T03 30 1.0 34 0.8 S1 7T08 1 1.2 1 0.01 8T09 18 1.2 18.5 0.18 9T010 2.5 1.2 2.5 0.02 10T011 2 1.2 2 0.02 S2 13T014 6.5 10 7.5 0.015 14T015 4 10 4.5 0.009 13T023 5.2 10 6 0.012 S3 20T021 1.2 5 1 0.008 21T022 1.35 5 2 0.009 S4 17T018 3.2 3.3 4 0.022 16T019 3.2 3.3 3.5 0.026 S5 12T016 25 0.3 29 0.55 TEST 2000 VOLTS	-30561		1	L-365745	670	7606287 P109		1	T-408
1	1		TERMINAL BOARD FOR T-408	MICARTA 7 1/4 X 3 3/4 X 3/16			1	7705818 P5	671	7604945 P21		0	
3	3		INSULATOR FOR T-408	ISOLANTITE	-61115A		23	7808556 P1	672	7604945 P22		2	
1	1	T-409	TRANSFORMER - POWER	375 VA., 60 CYCLE WDG. TAPS VOLTS AMPS TURNS OHMS P1 1T02 220 0.85 240 3.6 P2 3T04 220 0.85 240 6 S1 5T06 110 1.7 125 1 S2 7T08 110 1.7 125 .65 TEST 2000 VOLTS	-30495		1	L-365737 OR R-1421	673	7606287 P110		0	T-409
1	1		TERMINAL BOARD FOR T-409	MICARTA 6 3/4 X 3 3/4 X 3/16			1	7705796 P2	674	7604945 P8		0	
3	3	VT-1	TUBE - R.F. OSCILLATOR	(TRANSMITTING TETRODE) R.F. SCREEN GRID OSCILLATOR OR POWER AMPLIFIER GLASS BASE, MEDIUM 4 PIN BAYONET, CERAMIC GRID & PLATE LEADS ARE SEPARATE LEADS THRU GLASS BULB HEATER CURRENT 3.25 AMPS. AT 10 VOLTS A.C. OR D.C. PLATE DISSIPATION 100 WATTS	-860	RE13A600A	38	WL-860	675	7502199 P7		8	VT-1,VT-2,VT-3

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X	X	VT-2	TUBE - R.F. 1ST INT. POWER AMP.	SAME AS VT-1	-860				676				
X	X	VT-3	TUBE - R.F. 2ND INT. POWER AMP.	SAME AS VT-1	-860				677				
1	1	VT-4	TUBE - R.F. POWER AMP.	R.F. SCREEN GRID POWER AMP. GLASS BASE, SPECIAL 2 PIN BAYONET AND ONE BAR CONTACT CERAMIC SCREEN GRID & PLATE. SPECIAL CAPS, CURRENT LEAD THRU SIDE OF GLASS BULB. HEATER CURRENT 10 AMPS. AT 11 VOLTS A.C. OR D.C. PLATE DISSIPATION 400 WATTS	-861	RE13A800A	38		678	7502199 P6		2	VT-4
2	2	VT-401	TUBE - INPUT AMPLIFIER	(TRIPLE GRID AMP.) AUDIO FREQUENCY TRIPLE CURRENT SUPER CONTROL AMP. BASE; SMALL SIX PIN BAYONET TYPE PHENOLIC, SMALL METAL CAP, HEATER CURRENT 0.3 AMP. AT 6.3 VOLTS	-6D6		37	6D6	679	7606287 P140		4	VT-401, VT-402
X	X	VT-402	TUBE - INPUT AMPLIFIER	SAME AS VT-401					680				
3	3	VT-403	TUBE - INTERSTAGE AMPLIFIER	KEYER PENTODE, GLASS BASE; MEDIUM 5 PIN BAYONET, SMALL METAL CAP, HEATER CURRENT 0.9 AMPS. 6.3 VOLTS A.C. OR D.C., PLATE DISSIPATION 25 WATTS	-807		38	807	681	7606287 P142		6	VT-403, VT-404, VT-408
X	X	VT-404	TUBE - INTERSTAGE AMPLIFIER	SAME AS VT-403	-807				682				
2	2	VT-405	TUBE - MODULATOR	R.F. POWER AMPLIFIER PENTODE, GLASS BASE; GIANT 5 PIN BAYONET PHENOLIC, MEDIUM METAL CAP, FILAMENT CURRENT 5 AMPS. AT 10 VOLTS A.C. OR D.C. PLATE DISSIPATION 125 WATTS	-803		38	803	683	7606287 P144		4	VT-405, VT-406
X	X	VT-406	TUBE - MODULATOR	SAME AS VT-405	-803				684				
1	1	VT-407	TUBE - MOD. LIMITER	(RECTIFIER - HIGH VACUUM) HALF WAVE RECTIFIER GLASS, BASE: MEDIUM 4 PIN BAYONET, PHENOLIC, MEDIUM METAL CAP HEATER CURRENT 5 AMPS. AT 2.5 VOLTS A.C.	-1616		37	1616	685	7606287 P146		2	VT-407
X	X	VT-408	TUBE - VOICE RELAY	SAME AS VT-403	-807				686				
1	1	VT-409	TUBE - COMPRESSOR LIMITED	(HIGH VACUUM RECTIFIER) BASE: SMALL SIX PIN BAYONET PHENOLIC. HEATER CURRENT 0.3 AMPS. AT 25 VOLTS A.C. OR D.C.	-25Z5		37	25Z5	687	7606287 P148		2	VT-409

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3	3	X-1	SOCKET - M.O. TUBE	7 1/2 WATT, 4 CONTACTS, BAYONET TYPE	-49309		1		688	7605251 P16		2	X-1,X-2,X-3
X	X		BINDING POST FOR X-1	SAME AS ITEM 40					689				
X	X	X-2	SOCKET - 1ST INT. AMP. TUBE	SAME AS X-1	-49309				690				
X	X		BINDING POST FOR X-2	SAME AS ITEM 40					691				
X	X	X-3	SOCKET - 2ND INT. AMP. TUBE	SAME AS X-1	-49309				692				
X	X		BINDING POST FOR X-3	SAME AS ITEM 40					693				
1	1	X-4	SOCKET - P.A. TUBE	FILAMENT FOR TUBE TYPE -861	-49316A		1		694	7705850 G2		1	X-4
1	1	X-5	SOCKET - P.A. TUBE	GRID FOR TUBE TYPE -861	-49315A		1		695	7705850 G1		1	X-5
3	3	X-401	SOCKET	6 PRONG ISOLANTITE			3	TYPE S6	696	7706776 P8		2	X-401,X-402,X-409
3	3		TUBE CLAMP FOR X-401				1	7407075 G2	697	7409970 P49		1	
X	X	X-402	SOCKET	SAME AS X-401					698				
X	X		TUBE CLAMP FOR X-402	SAME AS ITEM 697					699				
3	3	X-403	SOCKET	5 PRONG ISOLANTITE			3	TYPE S5	700	7706776 P7		2	X-403,X-404,X-408
4	4		TUBE CLAMP FOR X-403				1	7605035 G13	701	7409970 P24		1	
X	X	X-404	SOCKET	SAME AS X-403					702				
X	X		TUBE CLAMP FOR X-404	SAME AS ITEM 701					703				
2	2	X-405	SOCKET	5 PRONG	-49356		1	7707644 G1	704	7606287 P115		1	X-405,X-406
2	2		TUBE CLAMP FOR X-405				1	7706940 G7	705	7409970 P23		1	
X	X	X-406	SOCKET	SAME AS X-405	-49356				706				
X	X		TUBE CLAMP FOR X-406	SAME AS ITEM 705					707				
1	1	X-407	SOCKET	4 PRONG ISOLANTITE			3	TYPE S4	708	7706776 P6		1	X-407
X	X		TUBE CLAMP FOR X-407	SAME AS ITEM 701					709				
X	X	X-408	SOCKET	SAME AS X-403					710				
X	X		TUBE CLAMP FOR X-408	SAME AS ITEM 701					711				

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER
X	X	X-409	SOCKET	SAME AS X-401					712	
X	X		TUBE CLAMP FOR X-409	SAME AS ITEM 697					713	
X	X		BINDING POST FOR X-5	SAME AS ITEM 40					714	
4	4		SHOCK MOUNTS FOR X-4 & X-5				26	CAT #100 P4	715	7810310 P33
1	1		PLATE FOR X-4	MICARTA 7 X 2 X 3/16 TK.			1	7806322 P3	716	7708395 P4
1	1		SUPPORT FOR R-8,R-10,R-12, R-23,R-24,R-25	MICARTA 1¼ 1/2 X 1 1/2 X 1/2 TK			1	7405501 P3	717	7406205 P4
1	1		SUPPORT FOR R-8,R-10,R-12, R-23,R-24,R-25	MICARTA 1¼ 1/2 X 1 1/2 X 1/2 TK			1	7405501 P4	718	7406205 P3
2	2		SUPPORT FOR R-4,R-7,R-17,R-29 R-32,R-34,R-35	MICARTA 6 1/2 X 1 X 1/2 TK			1	7705854 P3	719	7606329 P38
1	1		SUPPORT FOR R-4,R-7,R-17, R-29,R-32,R-34,R-35	MICARTA 6 1/2 X 3 3/4 X 1/2 TK			1	7705854 P7	720	7606329 P34
1	1		SUPPORT FOR R-1,R-2,R-3,R-15, R-16,R-19,R-21,R-28,R-45,R-46 R-47,R-48	MICARTA 23 X 2 1/2 X 1/2 TK			1	7707030 P2	721	7606329 P4
1	1		SUPPORT FOR R-1,R-2,R-3,R-15, R-16,R-19,R-21,R-28,R-45, R-46,R-47,R-48	MICARTA 23 X 2 1/2 X 1/2 TK			1	7707030 P4	722	7606329 P65
1	-		PANEL FOR MAG. CON.	MICARTA 16 3/4 X 12 X 3/4 TK			1		723	45-J-406 P19
-	1		PANEL FOR MAG. CON.	SAME AS ITEM 723					724	
1	1		FUSE PANEL FOR G-221	MICARTA			1	74-C-392	725	33-J-174 P64
8	8		FUSE INSULATOR FOR G-221	CERAMIC			1		726	33-J-174 P113
1	1		FUSE PANEL FOR G-211	MICARTA			1	74-C-546	727	33-J-176 P63
X	X		FUSE INSULATORS FOR G-211	SAME AS ITEM 726					728	
1	1		SUPPORT FOR ITEMS 486,487, 488,489	MICARTA 15 5/8 X 1 X 1 TK			1	7407731 P1	729	7810310 P79
1	1		CONTACTOR PANEL	MICARTA 30 1/4 X 11 7/8 X 1/2 TK.			1	7606132 P3	730	7607287 P3

SPARE PARTS

EQUIP. BOX NUMBER	EQUIP. QUANTITY	ALL SYMBOL DESIGNATIONS INVOLVED
	0	
	0	
	0	
	0	
	0	
	0	
	0	
	0	
	0	
	0	
	0	
	4	
	0	
	0	
	0	
	0	
	0	

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
1	1		SHAFT EXTENSION FROM S-6 TO CONTROL "G"	MICARTA 14 3/4 OF 3/4 DIA.			1	7604199 P2	731	7604199 P2		0	
2	2		SUPPORT FOR R-11,R-13,R-18	MICARTA 7 1/4 X 1 X 1/2 TK.			1	7707030 P3	732	7606329 P27		0	
1	1		INSULATING SPACER FOR M.O. DIAL				1	7406751 P1	733	7810261 P25		0	
1	1		EXTENSION FROM S-1A & B TO CONTROL "A"	MICARTA TUBE 5 25/32 OF 3/4 O.D. X 5/16 I.D.			1	7810368 P1	734	7405714 P6		0	
1	1		INSULATOR FOR S-13	MICARTA 3 3/4 X 27/32 X 1/16 TK			1	7405465 P3	735	7810261 P31		0	
1	1		TERM. BD. FOR M.O. UNIT	MICALEX 5 1/2 X 1 3/4 X 3/16 TK			1	7808885 P1	736	7705829 P7		0	
1	1		SUPPORT FOR X-1	MICALEX 3 X 3 X 1/8 TK			1	7808541 P1	737	7705829 P10		0	
2	2		SUPPORT FOR X-1	MICALEX 3 X 1/2 X 3/8 TK			1	7808541 P2	738	7705829 P11		0	
6	6		SPACER - FEED THRU - TOP FLOOR P.A. FLOOR & M.O. UNIT	ISOLANTITE 17/32 OF 3/4 O.D. X 17/32 I.D.	-61123		23	7602239 P26	739	7702097 P2		3	
3	3		INSULATOR - FEED THRU-TOP FLOOR, P.A. FLOOR & M.O. UNIT	ISOLANTITE 1 1/8 OF 1/2 O.D. X .206 I.D.	-61126		23	7405822 P2	740	7702097 P8		2	
2	2		INSULATOR FOR M-9R	ISOLANTITE 2 X23/32 SQ.	-61106		23	7705360 P13	741	7607287 P21		1	
1	1		INSULATOR FOR VT-1 CONN.	ISOLANTITE 3 X 3/4 DIA.	-61064		23	7602239 P6	742	7705829 P16		1	
2	2		INSULATOR - FREED THRU FOR M.O. UNIT	ISOLANTITE	-61116		23	7810261 P18	743	7810261 P18		1	
4	4		INSULATOR - FEED THRU FOR M.O. UNIT	ISOLANTITE	-61045		23	7810261 P19	744	7810261 P19		2	
12	12		BUSHING FOR FEED THRU INSULATOR CONTACTOR PANEL	ISOLANTITE	-611028		23	7405822 P8	745	7702097 P20		3	
4	4		INSULATOR FOR LARGE COUP.	ISOLANTITE - SPECIAL	-61132		23	7402096 P1	746	7607465 P4		2	
2	2		INSULATOR FOR SMALL COUP.	ISOLANTITE - SPECIAL	-61133		23	7402096 P2	747	7607465 P15		1	
24	24		INSULATOR - FEED THRU CONTACTOR PANEL	PRESTITE	-61123S		1	50-C-695 P1	748	7702097 P43		6	
66	66		INSULATOR FOR RESISTOR MOUNTING	PRESTITE			1	50-C-682 P3	749	7406205 P16		10	

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
1	1		COUPLING - LARGE FOR C-42 CONTROL "J"				1	7607465 G16	750	7810310 P321		0	
1	1		COUPLING - LARGE FOR C-41 CONTROL "H"				1	7607465 G12	751	7604452 P22		0	
1	1		COUPLING - LARGE FOR C-21 CONTROL "D"				1	7607465 G22	752	7810310 P30		0	
3	3		COUPLING - LARGE FOR L-9 CONTROL "E" LARGE FOR L-13 CONTROL "K" LARGE FOR L-14 CONTROL "F"				1	7607465 G10	753	7409127 P42		0	
1	1		COUPLING - SMALL L-9,C-29				1	7607465 G13	754	7810310 P281		0	
1	1		COUPLING - SMALL L-14,C-39				1	7607465 G14	755	7810310 P322		0	
1	1		COUPLING - L-1 FOR CONTROL "C"				1	7710266 G2	756	7810261 P89		0	
4	4		SPRING FOR M.O. UNIT - TOP	STEEL - 1/2 I.D., .125 DIA. WIRE			19	7807085 P15	757	7810310 P101		0	
4	4		SPRING FOR M.O. UNIT-BOTTOM	STEEL - 1/2 I.D., .095 DIA. WIRE			19	7817085 P25	758	7810310 P102		0	
4	4		SPRING FOR P.A. TUBE DOOR & BOTTOM DOOR	PHOS. BRONZE 3/8 LG X 7/16 I.D.			19	7805297 P3	759	7706392 P5		0	
2	2		SPRING FOR DOOR STAY	NICKEL SILVER- SPECIAL			1	7705787 P7	760	7705787 P7		0	
1	1		CONTROL "B" SPARE	M.O. DIAL LESS DETENT MECHANISM FOR S-1C			1	7604980 G7	761			0	
1	1		CONTROL "D"	1ST I.A. TUNING DIAL WITH NP-19388 "D" ATTACHED			1	7609308 G8	762	7810310 P8		0	
1	1		CONTROL "J"	ANT. TUNING CAPACITOR DIAL WITH NP-19388 "J" ATTACHED			1	7609308 G1	763	7810310 P9		0	
1	1		CONTROL "K"	ANTENNA TUNING COIL DIAL WITH NP-19388 "K" ATTACHED			1	7609317 G3	764	7810310 P10		0	
1	1		CONTROL "H"	ANT. COUPLING CAPACITOR DIAL WITH NP-19388 "H" ATTACHED			1	7609317 G1	765	7810310 P11		0	

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

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1	1		CONTROL "F"	P.A. TUNING COIL DIAL WITH NP-19388 "F" ATTACHED			1	7609317 G2	766	7810310 P12		0	
1	1		CONTROL "E"	2ND I.A. DIAL WITH NP-19388 "E" ATTACHED			1	7609317 G2	767	7810310 P13		0	
1	1		CONTROL "C"	M.O. TANK COIL DIAL WITH NP-19388 "C" ATTACHED			1	7609308 G2	768	7705824 P29		0	
6	6		FUSE CLIPS FOR G-211				1	S#585296	769	33-J-176 P68		1	
4	4		FUSE CLIPS FOR G-211				1	S#585295	770	33-J-176 P85		2	
X	X		FUSE CLIPS FOR G-221	SAME AS ITEM 769					771				
X	-		FUSE CLIPS FOR MAG. CON.	SAME AS ITEM 770					772				
-	X		FUSE CLIPS FOR MAG. CON.	SAME AS ITEM 770					773				
2	2		GREASE CUP FOR G-211				1	S#1295095	774	33-J-176 P109		0	
4	4		GREASE CUP FOR G-221				1	S#1266326	775	33-J-176 P81		0	
-	X		GREASE CUP FOR B-241	SAME AS ITEM 775					776				
X	-		GREASE CUP FOR B-271	SAME AS ITEM 775					777				
-	5		GASKET FOR B-241				1	33-P-4	778	5-D-7828		5	
5	-		GASKET FOR B-271	SAME AS ITEM 778					779			5	
14	14		GASKET FOR G-211				1	5-D-7928	780	33-J-176 P59		14	
X	X		GASKET FOR G-221	SAME AS ITEM 780					781				
52	52		CLIP	FOR MOUNTING RESISTORS			1	7610465 P3	782	7606329 P6, P66		5	
10	10		CLIP	FOR MOUNTING RESISTORS			1	7403619 P1	783	7606329 P35		1	
2	2		CLIP	FOR DOOR STAY			1	106870 P1	784	7705787 P6		0	
29	29		THUMB SCREW	SLOTTED FOR SHIELDS - 1 1/8 LG			1	7406179 P6	785	7607286 P29		0	
19	19		THUMB SCREW	SLOTTED FOR SHIELDS - 1 3/8 LG			1	7406179 P7	786	7607286 P30		0	
10	10		THUMB SCREW	PLAIN FOR SHIELD - 1 LG			1	7406179 P14	787	7605482 P4		0	
8	8		FULCRUM SCREW FOR S-5	FOR DETENT ARMS			1	7816704 P2	788	7603470 P52		0	

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
2	2		SHOULDER SCREW	FOR DOOR STAYS			1	7705787 P9	789	7705787 P9		0	
2	-		THUMB SCREW FOR MAG CON. DOOR				1	S#1289362	790			0	
-	2		THUMB SCREW FOR MAG. CONT. DOOR	SAME AS ITEM 790					791				
3	3		TERMINAL BLOCK	MICARTA - 12 SECTIONS			1	S#1225376	792	7707047 P4		0	
2	2		TERMINAL BLOCK	MICARTA - 5 SECTIONS			1	S#1225374	793	7810310 P297		0	
4	4		TERMINAL BLOCK	MICARTA - 10 SECTIONS			1	S#1225376	794	7810310 PTS409 410,411,412		0	
4	4		SHOCKMOUNTS FOR B-1				26	S#100-PH-4	795	7706786 P8		2	
			TERMINAL	FOR #6 SCREW			1	S#552413	796			12	
			TERMINAL	FOR #8 SCREW			1	S#867478	797			12	
			TERMINAL	FOR #10 SCREW			1	S#867295B	798			12	
			TERMINAL	FOR 1/4 SCREW			1	S#867508	799			12	
			WIRE	300 V. HOOK-UP WIRE 41 OF 0.005					800			3 FT	
			WIRE	LENZ "AEROGLAS" 65 OF .010 WHITE			16	5 MV	801			2DFT	
1	1		SUPPORT FOR R-410 & R-411	MICARTA 3 1/16 X 3 7/8 X 3/16			1	7407367 P1	802	7707107 P22		0	
1	1		SUPPORT FOR R-402,R-403,R-404 R-407,R-408,R-425	MICARTA 4 1/8 OF 1/8 TK, 3 1/8 X 5/16 LEG			1	7707893 G2	803	7707893 G1		0	
1	1		SUPPORT FOR R-405,R-406, R-414,R-418,R-419,R-420, R-421	MICARTA 11 3/4 X 3 5/8 X 3/8			1	7606190 G4	804	7606190 G1		0	
1	1		SUPPORT FOR R-414, R-419, R-420,R-421	MICARTA 11 3/4 X 1 1/4 x 3/8			1	7606190 P3	805	7606190 G2		0	
1	1		SUPPORT FOR ITEMS 804 & 805	MICARTA 11 1/4 X 1 X 3/8			1	7606190 P4	806	7606190 G1		0	
1	1		SUPPORT FOR ITEMS 804 & 805	MICARTA 11 1/4 X 2 X 3/8			1		807	7608889 P3		0	
1	1		SUPPORT FOR FUSE CUTOUT & LINK	MICARTA 7 1/4 X 2 7/8 X 1/4			1	7707223 P2	808	7707223 G1		0	

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

TOTAL USED PER EQUIP. 115 DC	TOTAL USED PER EQUIP. 230 DC	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. NUMBER	MFR.	MFR. DESIG.	CONTRACTOR'S ITEM NO.	CONTRACTOR'S DRAWING NUMBER	SPARE PARTS EQUIP. BOX NUMBER	SPARE PARTS EQUIP. QUANTITY	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
2	2		INSULATOR FOR HIGH VOLTAGE LEAD THRU	ISOLANTITE 17/32 OF 3/4 O.D. X 17/32 I.D.	-61123		23	7602239 P26	809			1	
1	1		INSULATOR FOR HIGH VOLTAGE LEAD THRU	ISOLANTITE 1 1/8 OF 1/2 O.D. X .206 I.D.	-61126		23	7405822 P2	810			1	
4	4		INSULATOR - STANDOFF FOR HIGH VOLTAGE LEADS TO MODULATION METER	SAME AS ITEM 129	-61043				811			2	
3	3		SPREADER FOR H.V. LEADS TO MODULATION METER	MICARTA 2 5/8 X 1 X 1/8			1	7407459 P3	812	7407459 G1		0	
X	X		INSULATOR - STANDOFF FOR PLATE LEADS TO VT-405,VT-406	SAME AS ITEM 668	-61028				813				
1	1		INSULATOR - STANDOFF FOR PLATE LEADS TO VT-407		-61108		1	7705360 P15	814	7606292 P147		1	
2	2		TERMINAL BLOCK	MICARTA - 12 SECTIONS			1	S#1225376	815			0	
5	5		TERMINAL BLOCK	MICARTA - 8 SECTIONS			1	S#1225375	816	7707234 PTS-1, 2,3,5,6		0	
1	1		STRIP - MTG FOR H.V. TERMS.	MICARTA - 6 3/8 X 1 3/4 X 3/8			1	7407436 P1	817	7407436 G1		0	
4	4		INSULATOR BUSHING FOR HIGH VOLTAGE TERMINALS	ISOLANTITE	-61143		1	7405822 P6	818	7702097 P16		2	
8	8		INSULATOR SPACER FOR HIGH VOLTAGE TERMINALS	PRESTITE	-61123S		1	50-C-695 P1	819	7702097 P43		4	
12	12		CLIP FOR RESISTOR				1	7610465 P3	820			1	
10	10		CLIP FOR RESISTOR				1	S#42340	821	7707107 P23		1	
4	4		CLIP FOR RESISTOR				1	7403619 P1	822			1	
2	2		CAP - LOCKING FOR R-409, R-432				1	7809771 P1	823	7707107 P37		0	
2	2		SCREW - SPARK GAP				1	7706544 P13	824	7606292 P107		0	
1	1		SCREW - SPARK GAP				1	7706544 P16	825	7408222 P25		0	
4	4		SHOCKMOUNTS FOR TUBE SHELF				1	7706786 P2	826	7409970 P3		1	
3	3		TUBE CAP & LEAD				1		827	7707240 P10		0	

PARTS AND SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

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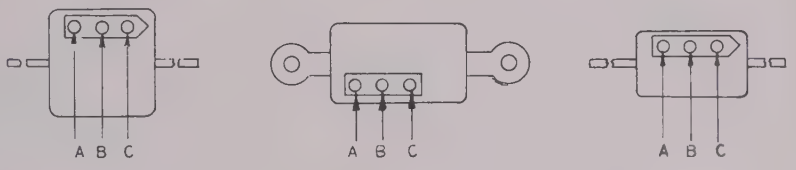
3	3		TUBE CAP & LEAD				1		828	7707240 P17		0	
2	2		TUBE CAP & LEAD				1		829	7707240 P45		0	
1	1		CABLE FOR HANDSET	5 FEET LONG			1	CD-220366	830			0	
			WIRES & TERMINALS				1		831	7707240 G2		1	
1	1		INSULATOR	1 3/4" DIA. 1 1/8" LONG - 4-#8-32 TAP HOLES EACH END.	-61478		23		832	7705360 P25		1	
1	1		INSULATOR	ISOLANTITE 2" LONG 1 1/4" DIA.			23	#325L2	833	7713527 P4		1	
1	1		SPACER	MICARTA 3/8 OF 1-5/16 I.D. X 1-7/8 O.D.			1		834	7713527 P7		1	

APPLICABLE COLOR CODES AND MISCELLANEOUS DATA

COLOR CODE IN MMFD. FOR CAPACITORS

COLOR	1ST DIGIT A	2ND DIGIT B	CIPHERS C
BLACK	-	0	.0
BROWN	1	1	0
RED	2	2	00
ORANGE	3	3	000
YELLOW	4	4	0000
GREEN	5	5	00000
BLUE	6	6	000000
PURPLE	7	7	0000000
GRAY	8	8	00000000
WHITE	9	9	--



RCA COLOR CODED CAPACITORS CAPACITY IN MMFD.

VALUES DESIGNATE TOLERANCE BY COLOR

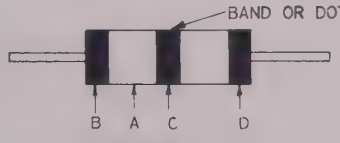
YELLOW ±20% BLUE ±10% BLACK ±5%

RMA COLOR CODE FOR RESISTORS

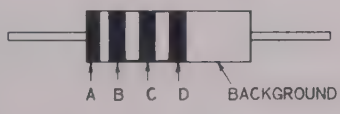
COLOR	1ST DIGIT A	2ND DIGIT B	CIPHERS C
BLACK	-	0	.0
BROWN	1	1	0
RED	2	2	00
ORANGE	3	3	000
YELLOW	4	4	0000
GREEN	5	5	00000
BLUE	6	6	000000
PURPLE	7	7	0000000
GRAY	8	8	00000000
WHITE	9	9	--

D- TOLERANCE CODE:

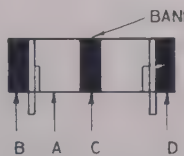
GOLD = 5% SILVER =10% OMIT = 20%



ORIGINAL COLOR ARRANGEMENT FOR AXIAL LEADS



NEW COLOR ARRANGEMENT FOR AXIAL LEADS



STANDARD COLOR ARRANGEMENT FOR RADIAL LEADS

TABLE III

LIST BY NAVY TYPE NUMBER FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

115 V.D.C.	230 V.D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			MISCELLANEOUS (CLASS 10)
8	8	TS-51	I-1B, I-2B, I-3B, I-4B, I-5B, I-6B, I-401C, I-402C, I-403C
X			I-1B, I-2B, I-3B, I-4B, I-5B, I-401C, I-402C, I-403C
	X		I-1B, I-3B, I-4B, I-5B, I-6B, I-401C, I-402C, I-403C
6	6		E-211, E-221
2	2		E-212
2	2		E-213
8	8		E-214, E-224
8	8		E-214A, E-224A
8	8		E-215A, E-225A
16	16		E-215B, E-225B
1	1		E-217
2	2		E-222
2	2		E-223
1	1		E-228
-	8		E-241
4	4		E-242, E-272
	X		E-242
X			E-272
-	2		E-243
-	4		E-244
8	8		E-245, E-283
	X		E-245
X			E-283
8	8		E-245A, E-275A
	X		E-245A
X			E-275A
2	2		E-246, E-276
	X		E-246
X			E-276

115 V.D.C.	230 V.D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			MISCELLANEOUS (CONTINUED) CLASS 10
2	2		E-247, E-277
	X		E-247
X			E-277
0	4		E-247A
4	4		E-248, E-278
	X		E-248
X			E-278
2	2		E-249, E-279
	X		E-249
X			E-279
-	1		E-250
8	-		E-271
4	-		E-277A
2	-		E-281
4	-		E-282
1	-		E-284
2	2		I-1A, I-4A
2	2		I-1C, I-402B
3	2		I-2A, I-3A, I-5A
X			I-2A, I-3A, I-5A
	X		I-3A, I-5A
3	4		I-2C, I-3C, I-6C, I-401B, I-403B
X			I-2C, I-401B, I-403B
	X		I-3C, I-6C, I-401B, I-403B
1	1		I-4C
1	1		I-5C
-	1		I-6A
2	2		I-401A, I-403A
1	1		I-402A
2	2		O-213

115 V.D.C.	230 V.D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			MISCELLANEOUS (CONTINUED) CLASS 10
1	1		O-214, O-224, O-242, O-274
	X		O-214, O-224, O-242
X			O-214, O-224, O-274
4	4		O-223, O-241, O-273
	X		O-223, O-241
X			O-223, O-273
			RECTOX CLASS 20
1	1		RX-401
2	2		RX-402, RX-403
			MOTORS & GENERATORS CLASS 21
1	1	-21131B	B-1
1	-	-21678	B-271
1	1	-21679	G-211
1	1	-21680	G-221
-	1	-21681	B-241
2	2		B-1A
2	2		B-1B
			ELECTRICAL INDICATING INSTRUMENTS CLASS 22
1	1	-22035	M-1
1	1	-22056	M-8
3	3	-22059	M-3, M-5, M-7
5	5	-22065	M-4, M-6, M-402, M-403, M-404
1	1	-22067	M-2
2	2	-22080	M-11, M-406

TABLE III

LIST BY NAVY TYPE NUMBER FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

115 V.D.C.	230 V.D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
ELECTRICAL INDICATING INSTRUMENTS (CONTINUED) CLASS 22			
1	1	-22199C	M-10
1	1	-22225	M-12
1	1	-22229A	M-405
1	1	-22311	M-9
1	1	-22318	M-401
SWITCHES CLASS 24			
5	5	-24067	S-14,S-15,S-16,S-406,S-407
1	1	-24069A	S-10
1	1	-24072	S-12
1	1	-24085	S-404
2	2	-24086	S-7,S-403
3	3	-24095A	S-3A,S-3B,S-3C
1	1	-24371	S-411
1	1		S-1C
1	1		S-2A
1	1		S-2C
1	1		S-2E
1	1		S-4A,S-4B
1	1		S-5A,S-5B,S-5C
1	1		S-6
1	1		S-8
1	1		S-9,S-9A
1	1		S-17
SWITCHES (CONTINUED) CLASS 24			
1	1		S-401
1	1		S-402
1	1		S-405
3	3		S-408,S-409,S-410
FUSES CLASS 28			
2	2		F-1,F-2
1	1		F-211
1	1		F-212
1	1		F-221
1	1		F-222
2	2		F-401,F-402
1 X	1 X		F-841,F-851 F-841 F-851
RELAYS CLASS 29			
1	1	-29046	K-20
1	1	-29056	K-2
1	1	-29062	K-9
1	1	-29064	K-4
1	1	-29091	K-401
1	1	-29169	K-1
1	1	-29195	K-5
1	1	-29196	K-7
1	-	-29353	K-841
-	1	-29354	K-851
RELAYS (CONTINUED) CLASS 29)			
2 X	2 X		K-842,K-843,K-852,K-853 K-842,K-843 K-852,K-853
1	-		K-844
-	1		K-854
VACUUM TUBES CLASS 38			
2	2	6D6	VT-401,VT-402
2	2	-803	VT-405,VT-406
3	3	-807	VT-403,VT-404,VT-408
3	3	-860	VT-1,VT-2,VT-3
1	1	-861	VT-4
1	1	-1616	VT-407
1	1	-25Z5	VT-409
THERMOMETERS & THERMOSTATS CLASS 40			
1	1	-40010	S-13
1	1	-40025	TH-1
1	1	-40034	S-11
TRANSFORMERS, INDUCTORS & CHOKES CLASS 30 & 47			
1	1	-30185	L-16
1	1	-30302	T-1
1	1	-30495	T-409
1	1	-30557	T-406
1	1	-30558	T-405

TABLE III

LIST BY NAVY TYPE NUMBER FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

115 V.D.C.	230 V.D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
TRANSFORMERS, INDUCTORS & CHOKES (CONTINUED) CLASS 30 & 47			
1	1	-30559	L-404
1	1	-30560	T-404
1	1	-30561	T-408
3	3	-30562	L-401, L-406, L-407
1	1	-30563	T-401
1	1	-30564	T-403
1	1	-30565	T-402
1	1	-30566	L-402
1	1	-30567	L-403
1	1	-30568	L-405
1	1	-30569	L-408
1	1	-30570	T-407
1	1	-47450	L-7
1	1	-47451	L-9, S-2D
2	2	-47452	L-10, L-15
1	1	-47453	L-12
1	1	-47454	L-11
2	2	-47455	L-6, L-8
1	1	-47456	L-19
3	3	-47457	L-5, L-17, L-18
1	1	-47458	L-3
1	1	-47465	T-3
1	1	-47481	L-14, S-2B
1	1	-47482	L-13
1	1		L-1, S-1A, S-1B
1	1		L-2

115 V.D.C.	230 V.D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
CAPACITORS CLASS 48			
1	1	-48001-10	C-67
10	10	-48027-10	C-4, C-5, C-8, C-9, C-17, C-18, C-26, C-27, C-35, C-36
2	2	-48035-10	C-19, C-28
6	6	-48037-10	C-12, C-16, C-25, C-33, C-34, C-37
1	1	-48039-10	C-15
2	2	-48197-A10	C-402, C-424
1	1	-48204-D2	C-7
1	1	-48205-A10	C-60
1	1	-48330-10	C-22
4	4	-48340	C-401, C-417, C-418, C-423
1	1	-48365-D2	C-2
2	2	-48382-10	C-20, C-30
17	17	-48410-10	C-10, C-11, C-23, C-24, C-31, C-32, C-43, C-46, C-50, C-51, C-52, C-404, C-407, C-409, C-410, C-413, C-416
1	1	-48423-5	C-57
2	2	-48477-D2	C-1, C-3
1	1	-48478-B5	C-6
1	1	-48481-D2	C-56
2	2	-48526-10	C-408, C-411
1	1	-48428-10	C-414
1	1	-48534-5	C-54
1	1	-48535-5	C-53
2	2	-48591-10	C-405, C-412
1	1	-48683-10	C-47
1	1	-48684-10	C-48

115 V.D.C.	230 V.D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
CAPACITORS (CONTINUED) CLASS 48			
2	2	-48685-10	C-58, C-65
3	3	-48686-10	C-45, C-63, C-64
2	2	-48687-10	C-420, C-421
2	2	-481170-10	C-425, C-426
1	1	-481171-10	C-419
1	1	-481214-5	C-66
1	1	-481215-5	C-40
1	1	-481216-5	C-49
1	1	-481289-	C-44
4	4	-482063-10	C-403, C-406, C-415, C-422
1	1	-482390	C-13
1	1	-482391	C-14
1	1	-482393	C-29
1	1	-482394	C-39
1	1	-482396	C-42
1	1	-482408	C-61
1	1		C-21
1	1		C-55
1	1		C-62
1	1		C-68
JACKS AND TUBE SOCKETS CLASS 49			
1	1	-49110	J-1
3	3	-49309	X-1, X-2, X-3
1	1	-49315A	X-5

TABLE III

LIST BY NAVY TYPE NUMBER FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

115 V.D.C.	230 V.D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
		JACKS AND TUBE SOCKETS (CONTINUED) CLASS 49	
1	1	-49316A	X-4
2	2	-49356	X-405,X-406
3	3		X-401,X-402,X-409
3	3		X-403,X-404,X-408
		HANDSET CLASS 51	
1	1	-51050	HS-401
		INSULATORS CLASS 61	
24	24	-61028	
8	8	-61029	
8	8	-61030	
2	2	-61032	
2	2	-61033	
10	10	-61043	
4	4	-61045	
5	5	-61061	
1	1	-61064	
1	1	-61068	
15	15	-61084	
5	5	-61106	
3	3	-61107	
1	1	-61108	
3	3	-61115A	
		INSULATORS (CONTINUED) CLASS 61	
2	2	-61116	
6	6	-61118	
8	8	-61123	
34	34	-61123S	
4	4	-61126	
12	12	-61128	
6	6	-61130	
4	4	-61132	
2	2	-61133	
1	1	-61141S	
4	4	-61143	
1	1	-61219	
2	2	-61232	
6	6	-61287	
6	6	-61288	
5	5	-61422S	
5	5	-61423S	
18	18	-61462	
1	1	-61478	
		RESISTORS CLASS 63	
1	1	-63067E	R-30
-	1	-63069E	R-7
-	2	-63071E	R-29,R-32
-	1	-63077E	R-36
		RESISTORS (CONTINUED) CLASS 63	
2	2	-63078F	R-435,R-436
2	2	-63085E	R-4,R-17
1	1	-63097E	R-22
1	1	-63124E	R-422
1	1	-63141E	R-12
5	5	-63149E	R-8,R-10,R-18,R-23,R-25
1	1	-63159E	R-24
4	4	-63204E	R-45,R-46,R-47,R-48
1	1	-63212E	R-3
1	1	-63224E	R-11
1	1	-63225E	R-414
3	3	-63227E	R-19,R-21,R-28
1	1	-63233E	R-16
1	1	-63236E	R-15
4	4	-63257E	R-13,R-419,R-420,R-421
1	1	-63288	R-50
2	2	-63288	R-402,R-403
1	1	-63288	R-404
1	1	-63288	R-405
1	1	-63288	R-406
2	2	-63288	R-407,R-408
1	1	-63288	R-412
2	2	-63288	R-418,R-425
1	1	-63288	R-426
-	1	-63289	R-49

TABLE III

LIST BY NAVY TYPE NUMBER FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

115 V.D.C.	230 V.D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED	115 V.D.C.	230 V.D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED	115 V.D.C.	230 V.D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
RESISTORS (CONTINUED) CLASS 63											
1	1	-63349E	R-433								
1	1	-63361E	R-2								
2	2	-63426	R-14, R-20								
1	1	-63484E	R-1								
-	1	-63506E	R-57								
2	2	-63545E	R-410, R-411								
1	-	-63553E	R-56								
1	-	-63732E	R-35								
-	1	-63733E	R-34								
1	1	-63775	M-9R								
1	1	-63813E	R-416								
2	2	-63814E	R-417, R-427								
2	2	-63844	R-409, R-432								
2	2	-632336	R-437, R-438								
1	1	-632378	R-33								
1	1	-632386	R-6								
0	1	-632410-10	R-851								
1	0	-632411-10	R-841								
1	1		R-26								
1	-		R-58								
1	1		R-401								
1	1		R-413								
1	1		R-415								
1	1		R-429								
1	0		R-843								
0	1		R-853								

TABLE V

LIST OF MANUFACTURERS

PARTS & SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

CODE NUMBER	MFR. PREFIX	NAME	ADDRESS
1	CAY	WESTINGHOUSE ELEC. & MFG. CO.	2519 WILKENS AVENUE BALTIMORE, MARYLAND
2	CD	CORNELL DUBILIER	SO PLAINFIELD, N.J.
3	CHC	HAMMARLUND MFG. CO.	424 WEST 33RD STREET NEW YORK, NEW YORK
4	CBK	ALLEN D. CARDWELL	81 PROSPECT STREET BROOKLYN, N.Y.
5	CLF	LITTELFUSE INC.	4757 RAVENSWOOD AVENUE CHICAGO, ILLINOIS
6		BRYANT ELECTRIC CO.	BRIDGEPORT, CONN.
7	CSD	STRUTHERS DUNN, INC.	139 N. JUNIPER STREET PHILADELPHIA, PA.
8	CN	NATIONAL ELEC. MACH. CO.	2014 5TH STREET N.E. WASHINGTON, D.C.
9	CNA	NATIONAL CO., INC.	61 SHERMAN STREET MALDEN, MASS.
10	CAO	WARD LEONARD ELECTRIC CO.	MOUNT VERNON, N.Y.
11	CSA	STACKPOLE CARBON CO.	ST. MARY'S, PENNSYLVANIA
12	CCC	CONTINENTAL CARBON CO.	13900 LORAIN AVENUE CLEVELAND, OHIO
13	CHH	ARROW HART & HEGEMAN	HARTFORD, CONN.
14	CGC	GENERAL CONTROL CO.	CAMBRIDGE, MASS.
15	CPT	PRECISION INST. & THER. CO.	1434 BRANDYWINE STREET PHILADELPHIA, PA.
16	CLE	LENZ ELECTRIC MFG. CO.	1751 N. WESTERN AVENUE CHICAGO, ILLINOIS
17	CAW	AEROVOX CORP.	NEW BEDFORD, MASS.
18	CDM	D.P. MOSSMAN INC.	CHICAGO, ILLINOIS
19		WALLACE BARNES CO.	BRISTOL, CONN.
20	CMR	MICAMOLD RADIO CORP.	1087 FLUSHING AVENUE BROOKLYN, N.Y.
	CSF	SPRAGUE SPECIALTIES CO.	NORTH ADAMS, MASS.
	CAN	SANGAMO ELEC. CO.	SPRINGFIELD, N.J.
	CD	CORNELL DUBILIER	SO. PLAINFIELD
	CSL	SOLAR MFG. CO.	BAYONNE, N.J.
	CAW	AEROVOX CORP.	NEW BEDFORD, MASS.
21	CSL	SOLAR MFG. CO.	BAYONNE, N.J.
22	CFA	BUSSMAN MFG. CO.	ST. LOUIS, MO.
23	CBU	ISOLANTITE INC.	343 COURTLAND STREET BELLEVILLE, N.J.
24	CEB	HUGH H. EBY	4700 STANTON AVENUE PHILADELPHIA, PA.
25	CCB	CHARLES BOND	617-23 ARCH STREET PHILADELPHIA, PA.
26		LORD MFG. CO.	1635 W. 12TH STREET ERIE, PA.

LIST OF MANUFACTURERS

PARTS & SPARE PARTS FOR TBM-12 RADIO TRANSMITTING EQUIPMENT

CODE NUMBER	MFR. PREFIX	NAME	ADDRESS
27		THE RAJAH COMPANY	LOCUST AVENUE BLOOMFIELD, N.J.
28	CAO	WARD LEONARD ELECTRIC CO.	MT. VERNON, N.J.
	CHD	HARDWICK-HINDLE INC.	NEWARK, N.J.
	CSF	SPRAGUE SPECIALTIES	NORTH ADAMS, MASS.
29	CAU	AUTOMATIC ELECTRIC CO.	1033 W. VAN BUREN STREET CHICAGO, ILLINOIS
30	CKU	KURMAN ELECTRIC COMPANY	241 LAFAYETTE STREET NEW YORK, N.Y.
31	CDN	DAVEN COMPANY	180 SUMMIT AT NEWMAN NEWARK, N.J.
		TECH LABORATORIES INC.	7 LINCOLN AVENUE JERSEY CITY, N.J.
32	CIR	INTERNATIONAL RESISTANCE CO.	401 N. BROAD STREET PHILADELPHIA, PA.
33	CSF	SPRAGUE SPECIALTIES CO.	NORTH ADAMS, MASS.
34	CG	GENERAL ELELTRIC CO.	SCHENECTADY, NEW YORK
35	CW	WESTERN ELECTRIC CO.	NEW YORK, N.Y.
36	CAS	AMERICAN LAVA CO.	CHATTANOOGA, TENN.
37		R.C.A. MFG. CO.	CAMDEN, N.J.
38	CWL	WESTINGHOUSE LAMP CO.	BLOOMFIELD, N.J.
39	CTC	CHICAGO TELEPHONE SUPPLY CO.	ELKHART, IND.

NOTES

A - A NUMBER IN THE POWER COLUMN DENOTES THE TOTAL QUANTITY OF SIMILAR COMPONENT PARTS USED IN THE EQUIPMENT FOR THAT PARTICULAR POWER SUPPLY.

B - A ZERO (0) DENOTES THAT FOR THAT PARTICULAR POWER SUPPLY, THE COMPONENT PART IS NOT USED.

C - A DASH (-) DENOTES THAT THE COMPONENT PART IS NOT USED BUT THAT SIMILAR COMPONENT PARTS, BEARING DIFFERENT SYMBOL DESIGNATIONS ARE USED.

D - AN (X) DENOTES THAT THE USE OF THE COMPONENT PART FOR THAT PARTICULAR POWER SUPPLY.

ITEM 141 - NAVY SPEC RE13A488 & PARS. 2-55 TO 2-59 OF RE13A490.

ITEM 240 - SAME AS S#867328B EXCEPT WITH ONLY NUT ON LONG STUD HOLDING RESISTOR. OMIT ALL OTHER HARDWARE. WEMCO TO ASSEMBLE WITH STANDARD HARDWARE AT ASSEMBLY.

ITEM 207 - SAME AS S#867327B EXCEPT AS NOTED FOR ITEM #204.

ITEM 222 - SAME AS S#867327B EXCEPT AS NOTED FOR ITEM #204.

ITEM 225 - SAME AS S#867327B EXCEPT AS NOTED FOR ITEM #204

ITEM 231 - PER SPEC RE49AA147, SHEET 5A LESS NAMEPLATE.

ITEM 256 - STRUTHER DUNN #CXA-2119, SAME AS CX-2119 EXCEPT WITHOUT COIL SERIES RESISTOR.

RESTRICTED

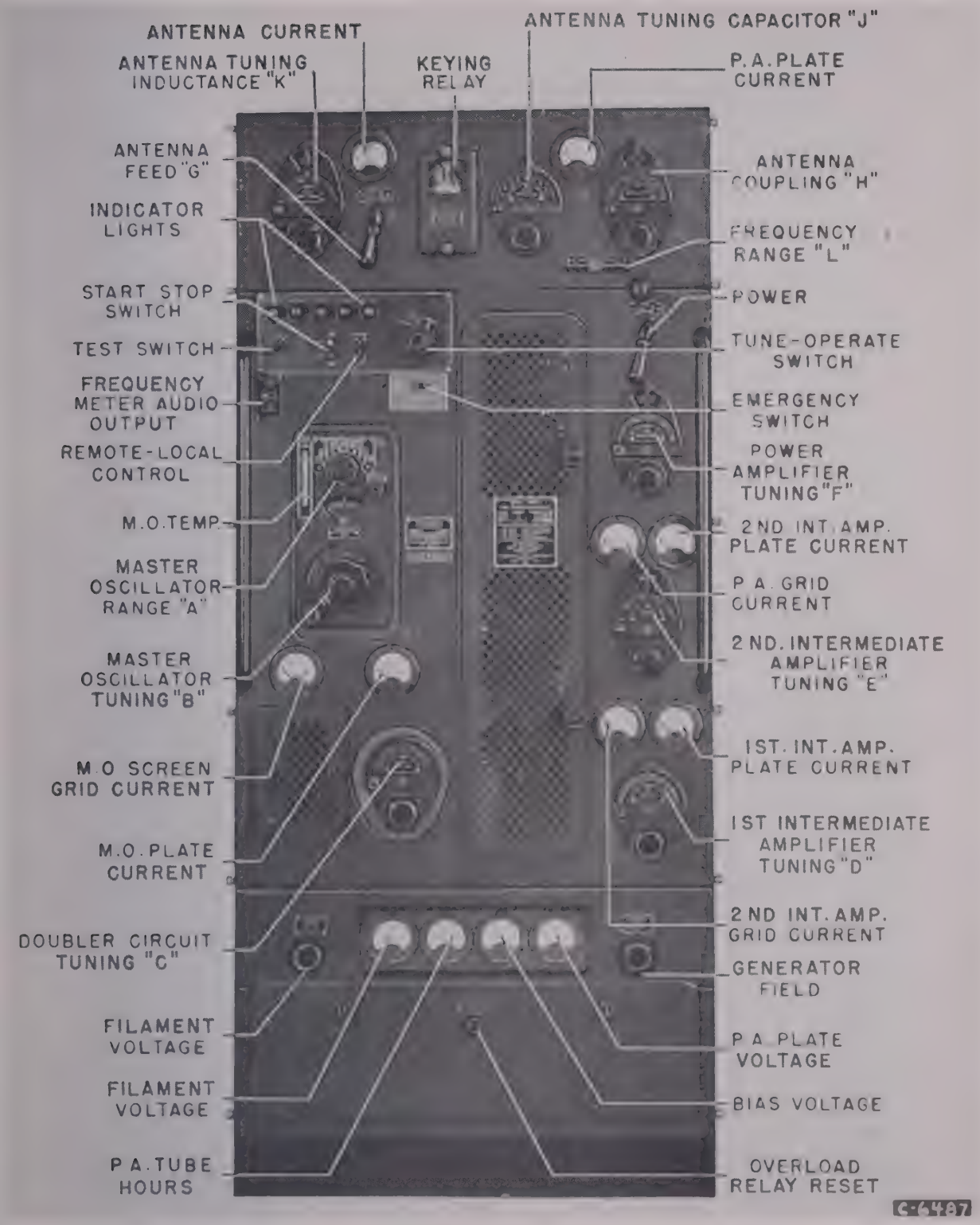


Figure 1—Radio Transmitter Unit, Navy Type CAY-52218, Front View (Photo C-6487)

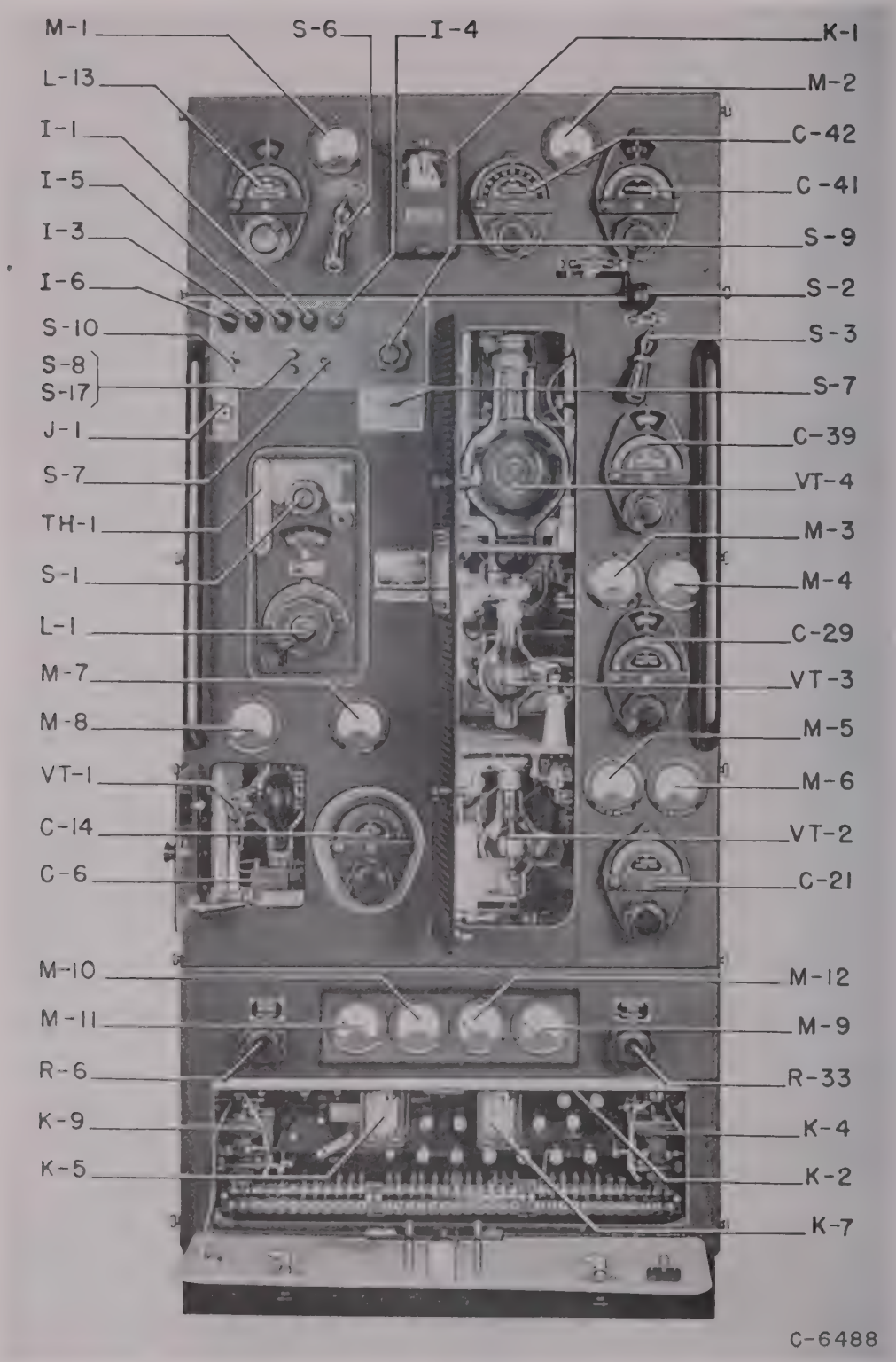


Figure 2—Radio Transmitter Unit, Navy Type CAY-52218, Front View, Access Doors Open (Photo C-6488)

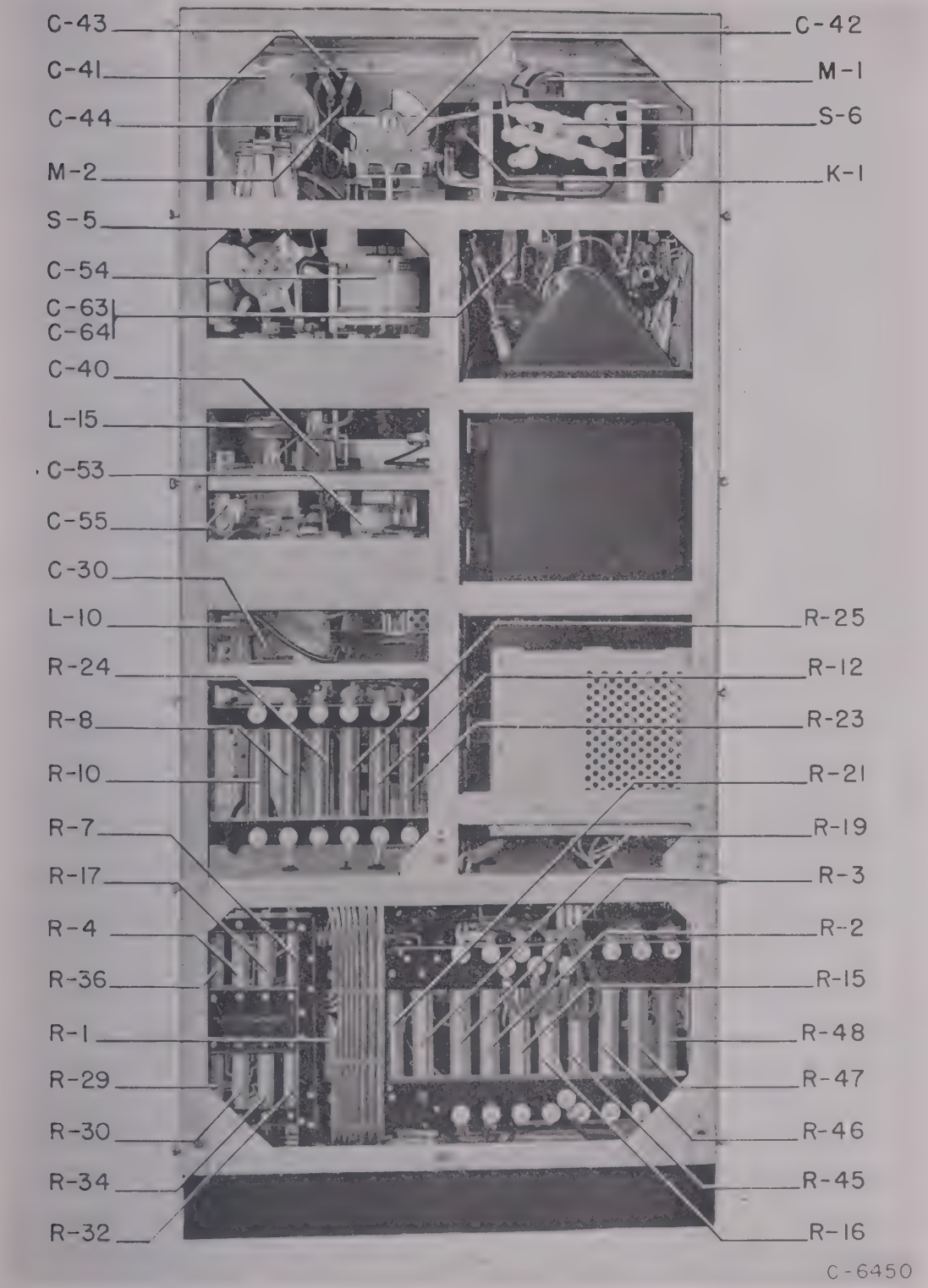


Figure 3—Radio Transmitter Unit, Navy Type CAY-52218, Rear View, Shields Removed (Photo C-6450)

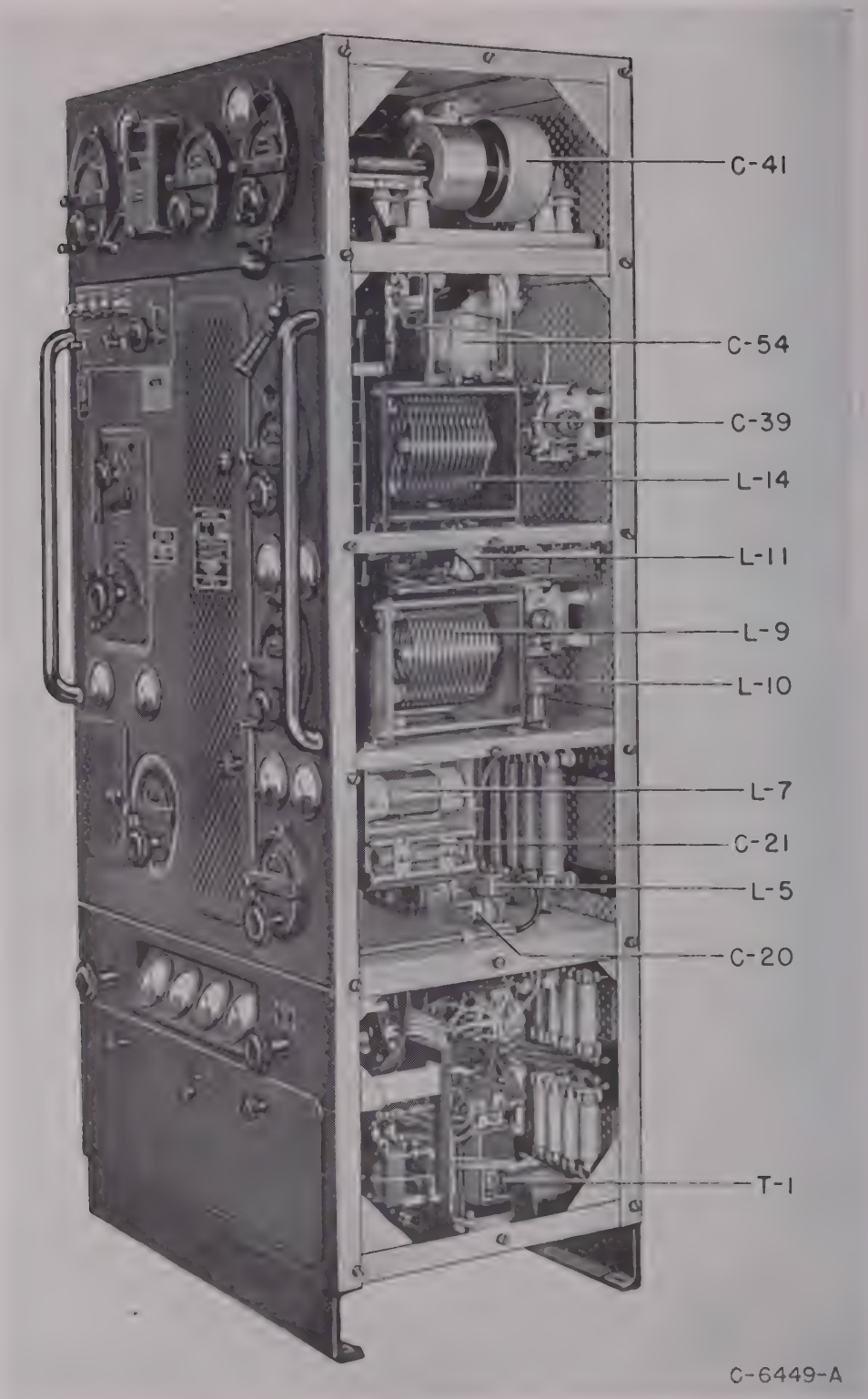


Figure 4—Radio Transmitter Unit, Navy Type CAY-52218, Front Oblique of Right Side, Shields Removed (Photo C-6449-A)

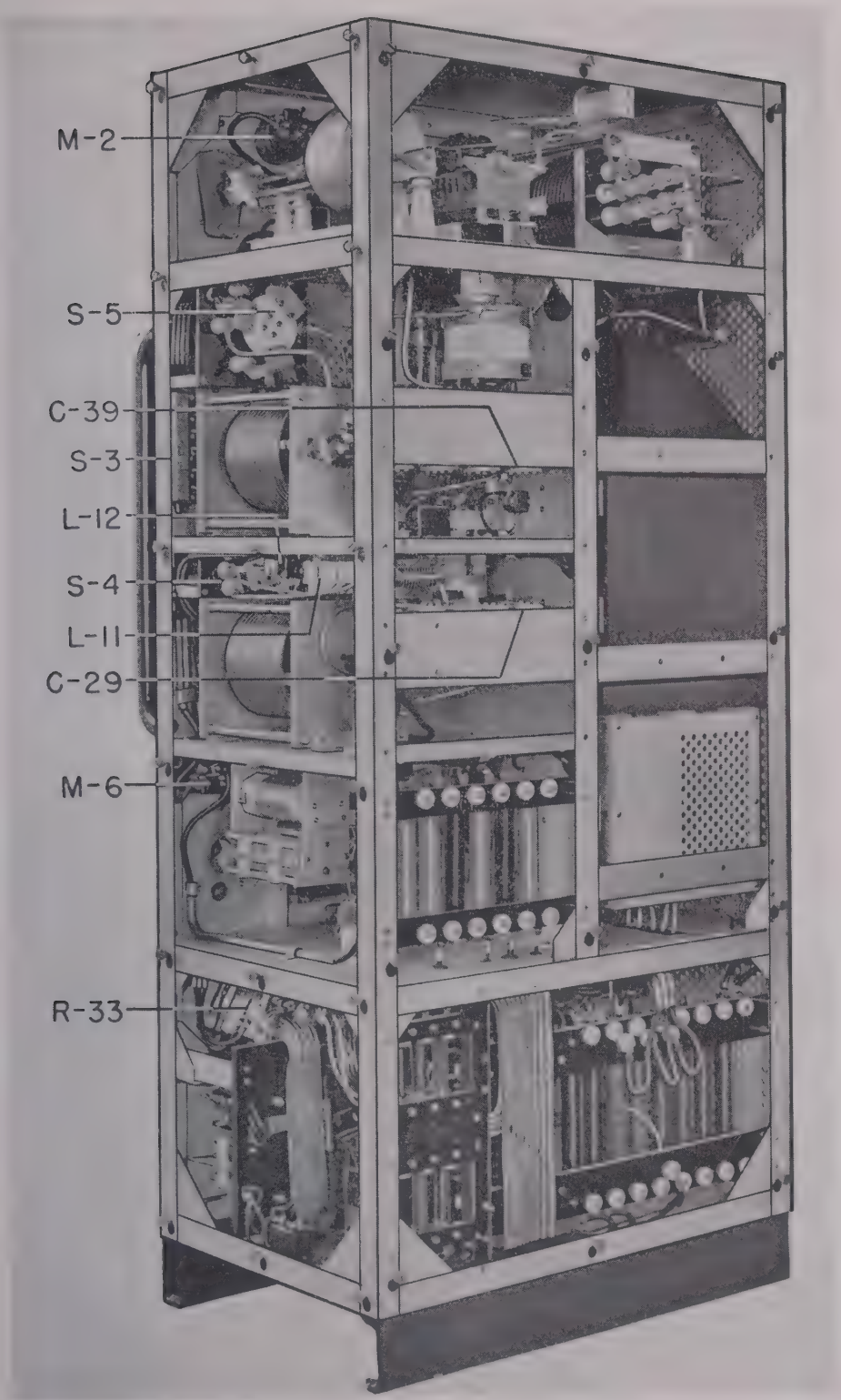


Figure 5—Radio Transmitter Unit, Navy Type CAY-52218, Rear Oblique of Right Side, Shields Removed (Photo C-5084)

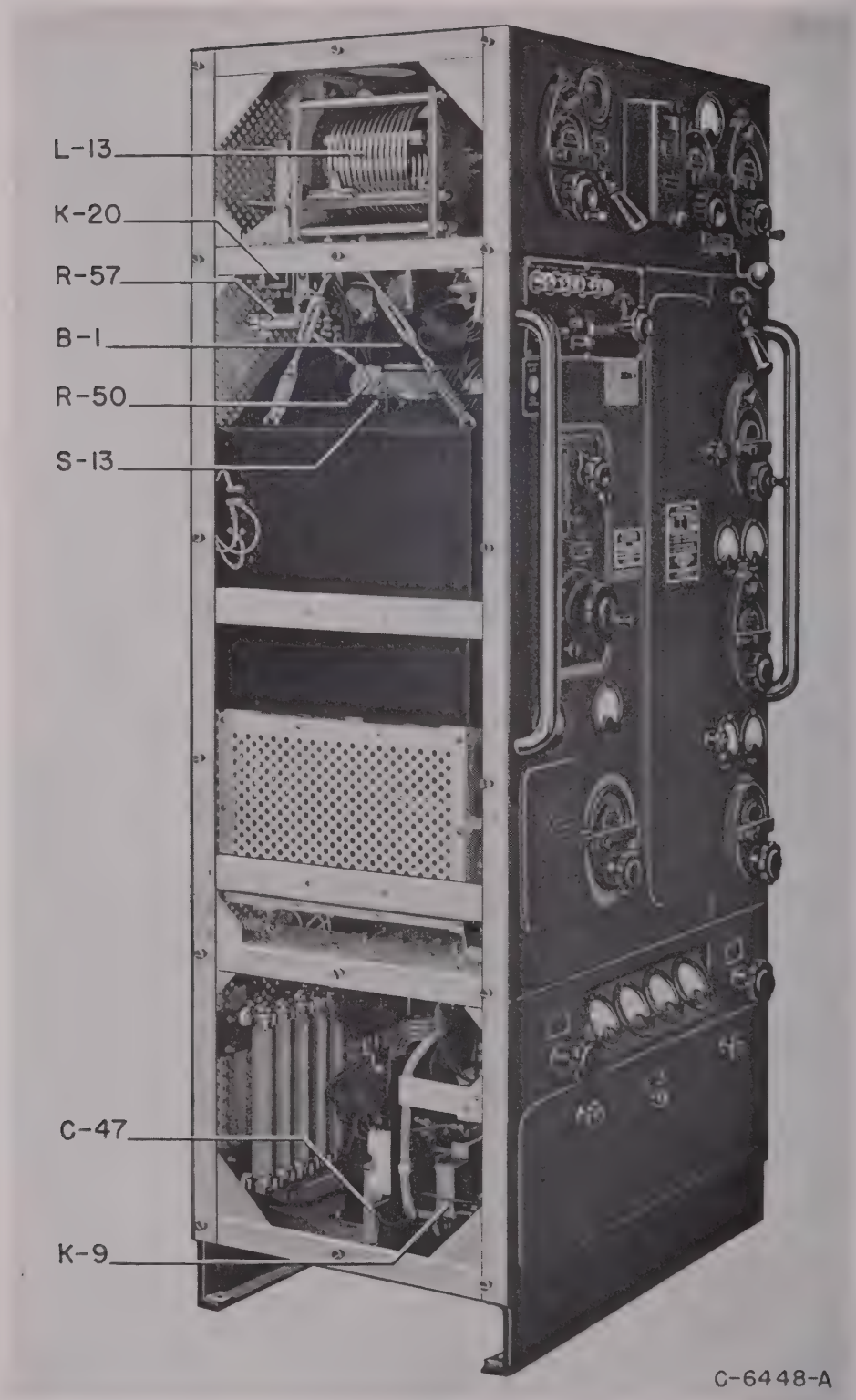


Figure 6—Radio Transmitter Unit, Navy Type CAY-52218, Front Oblique of Left Side, Shields Removed (Photo C-6448-A)

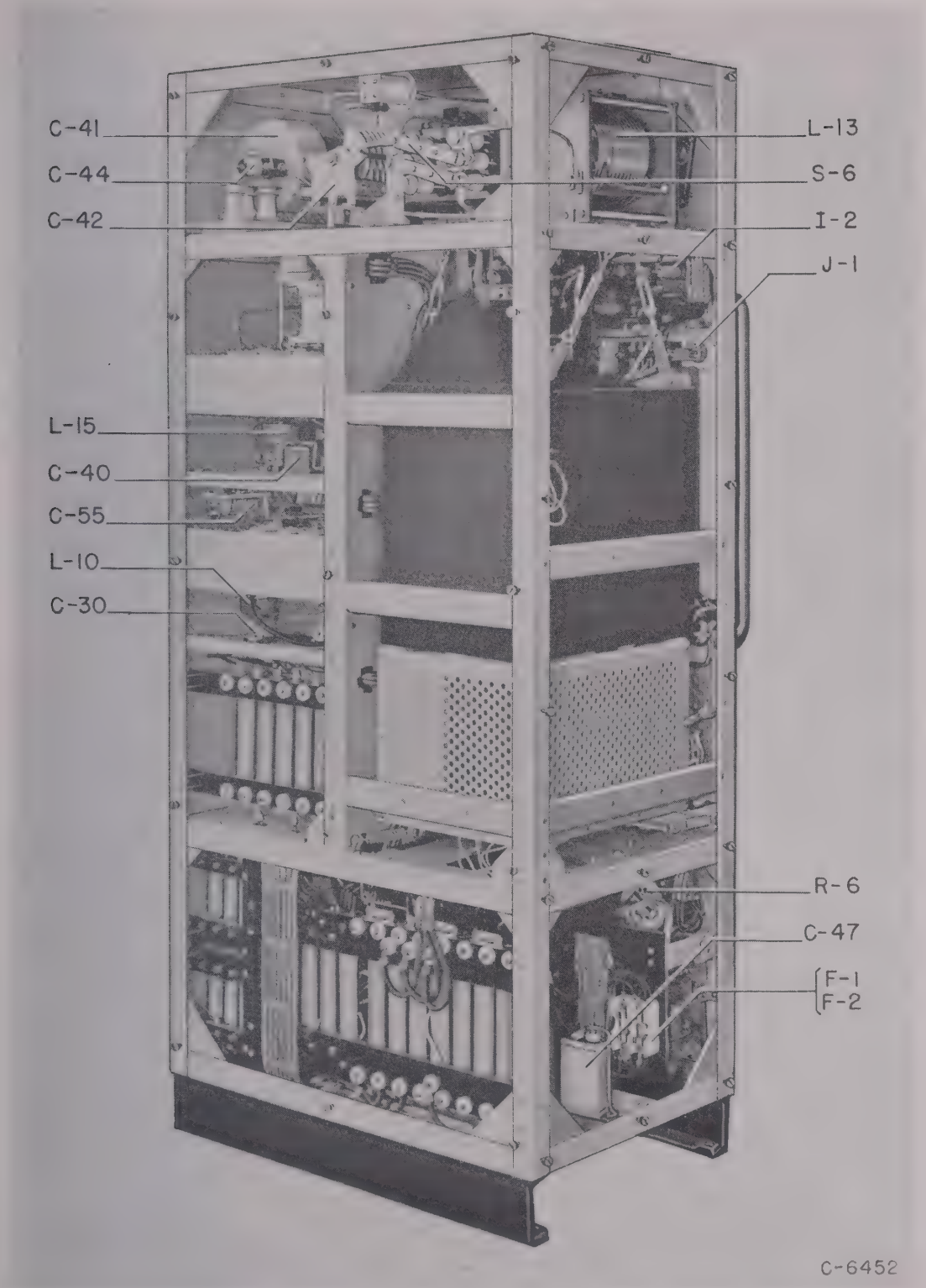


Figure 7—Radio Transmitter Unit, Navy Type CAY-52218, Rear Oblique of Left Side, Shields Removed (Photo C-6452)

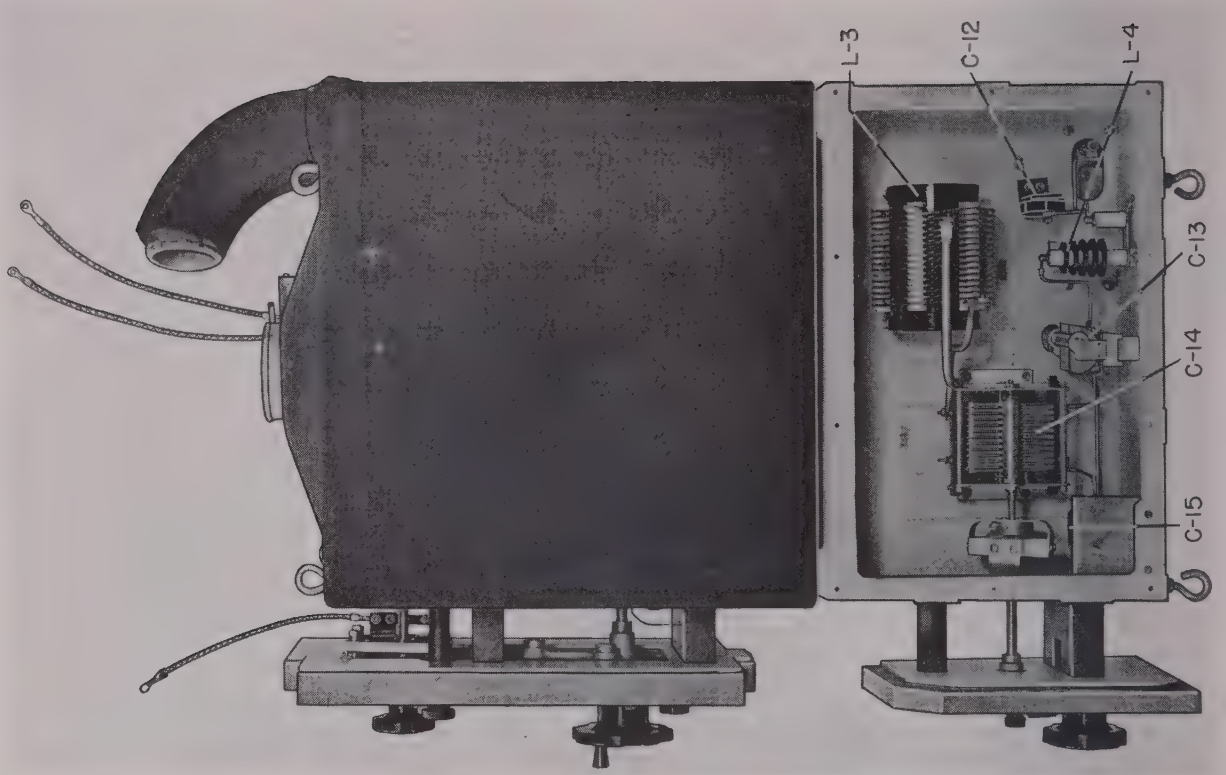


Figure 8—Master Oscillator Unit, Right Side, Shields Removed (Photo C-4908)

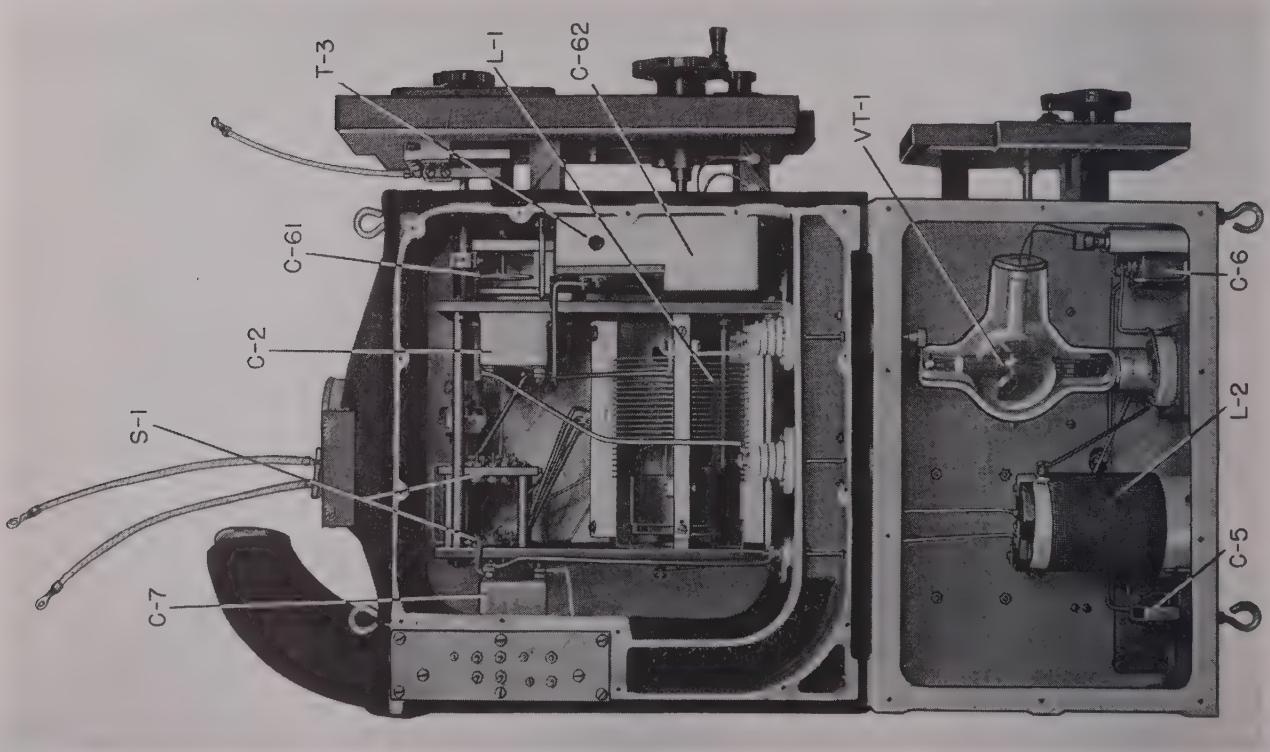


Figure 9—Master Oscillator Unit, Left Side, Shields Removed (Photo C-4906)

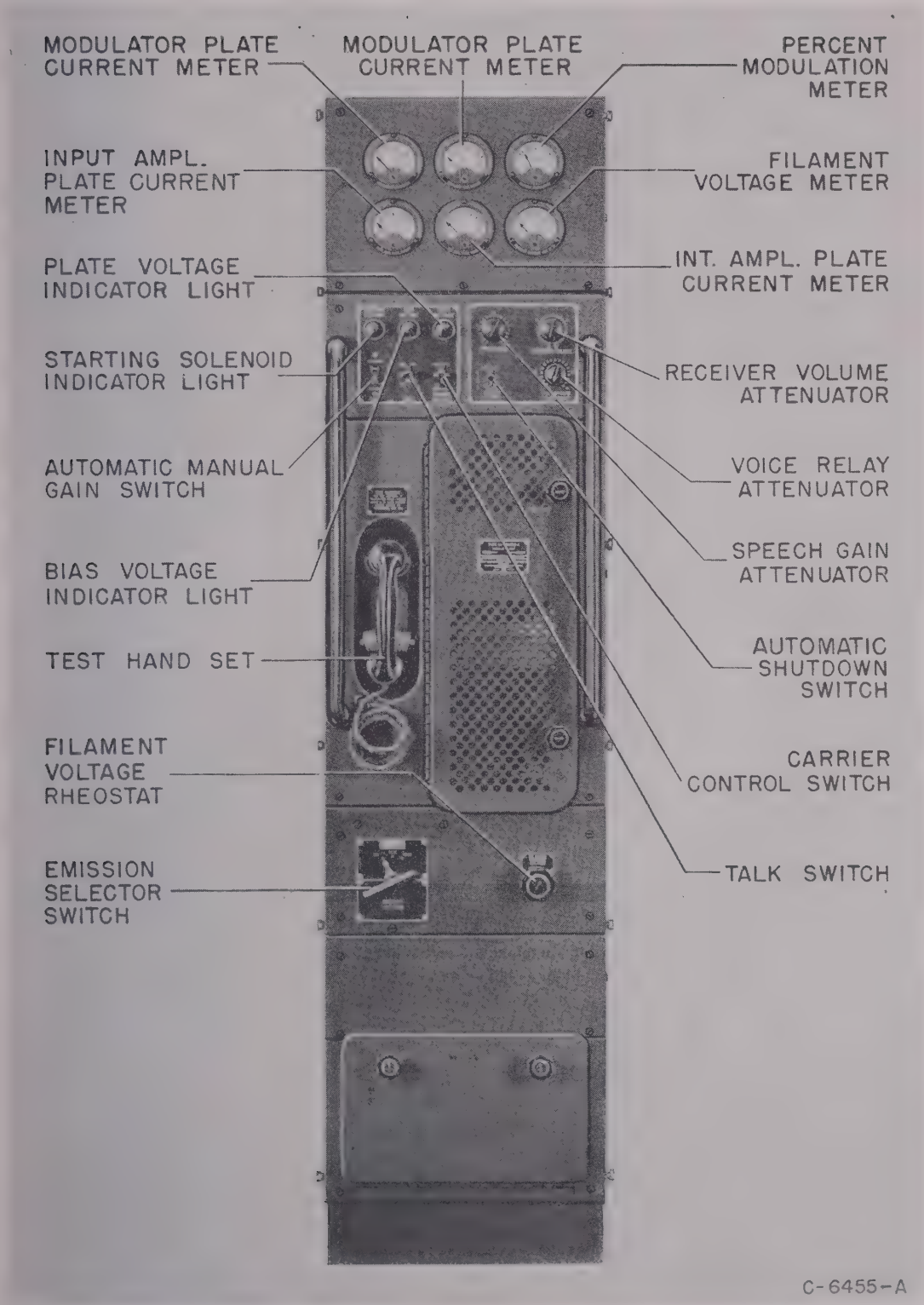


Figure 10—Modulator Unit, Navy Type CAY-50065-B, Front View (Photo C-6455-A)

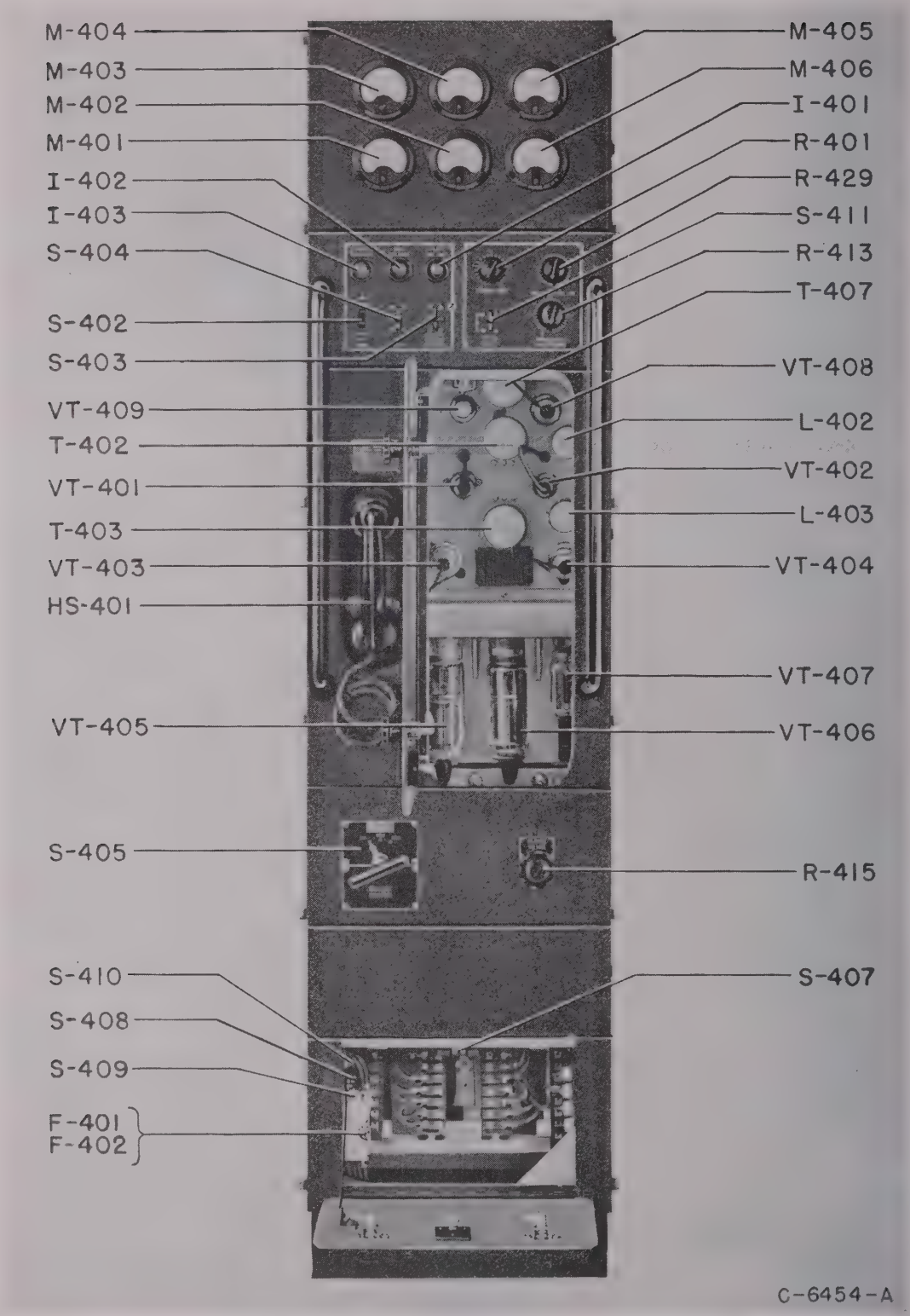


Figure 11—Modulator Unit, Navy Type CAY-50065-B, Front View, Access Doors Open (Photo C-6454-A)

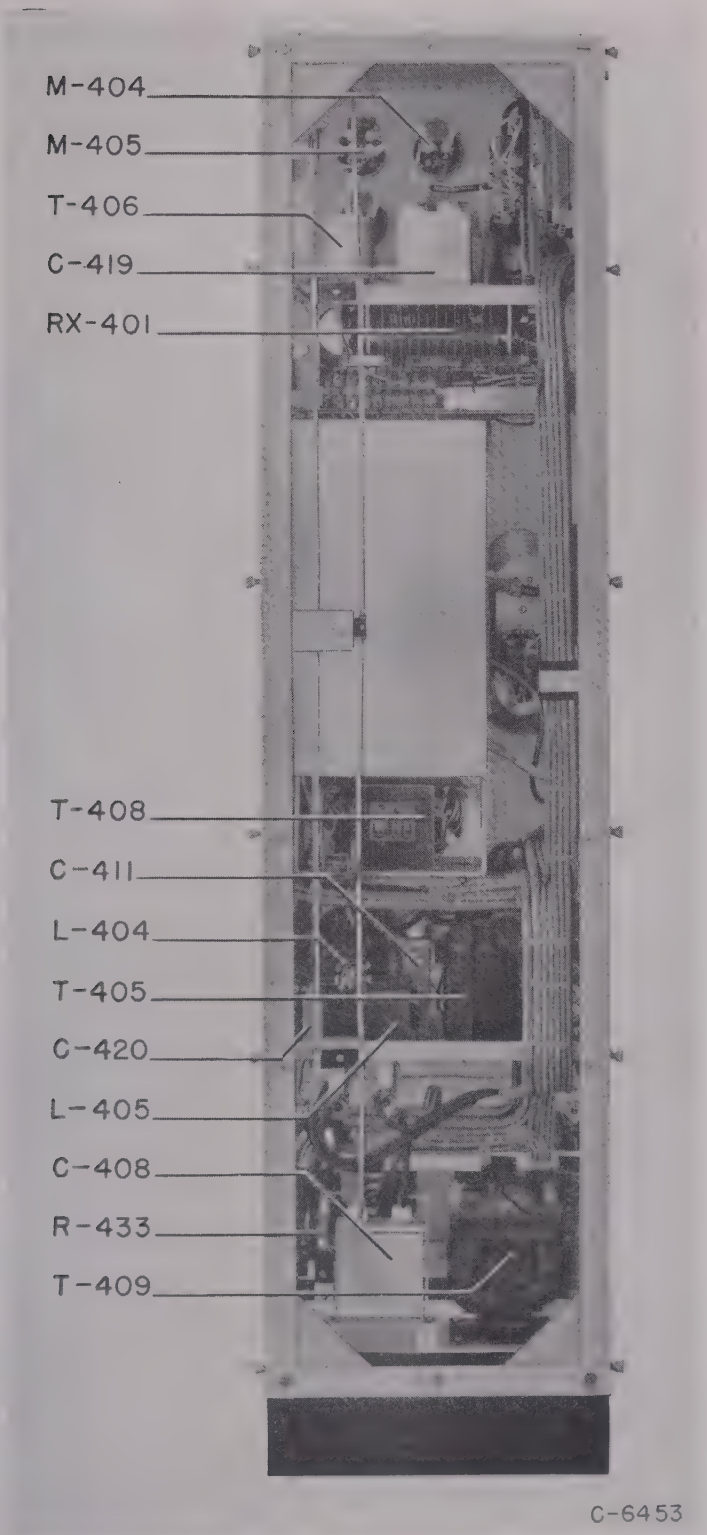


Figure 12—Modulator Unit, Navy Type CAY-50065-B, Rear View, Shields Removed (Photo C-6453)

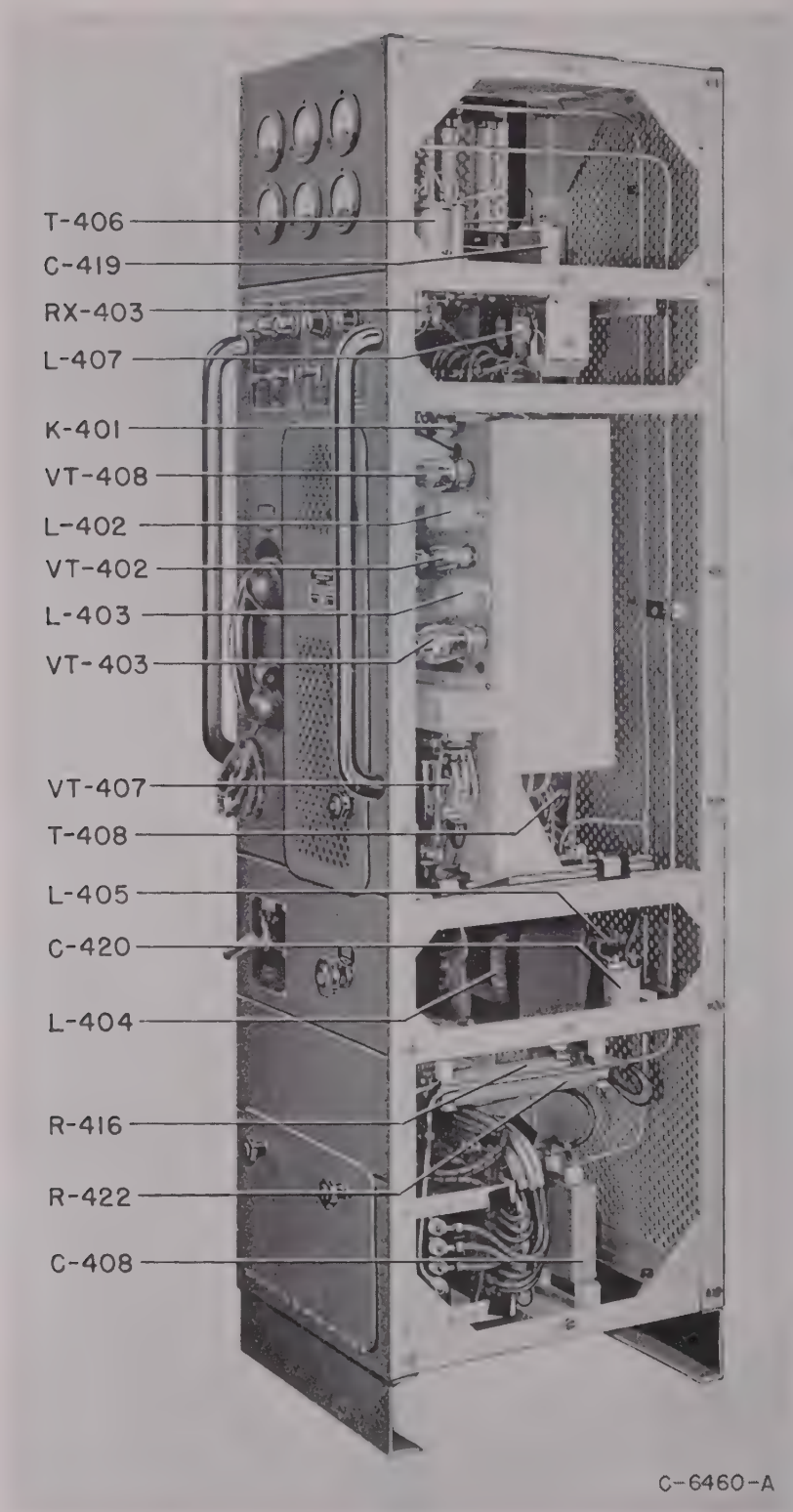


Figure 13—Modulator Unit, Navy Type CAY-50065-B, Front Oblique of Right Side, Shields Removed (Photo C-6460-A)

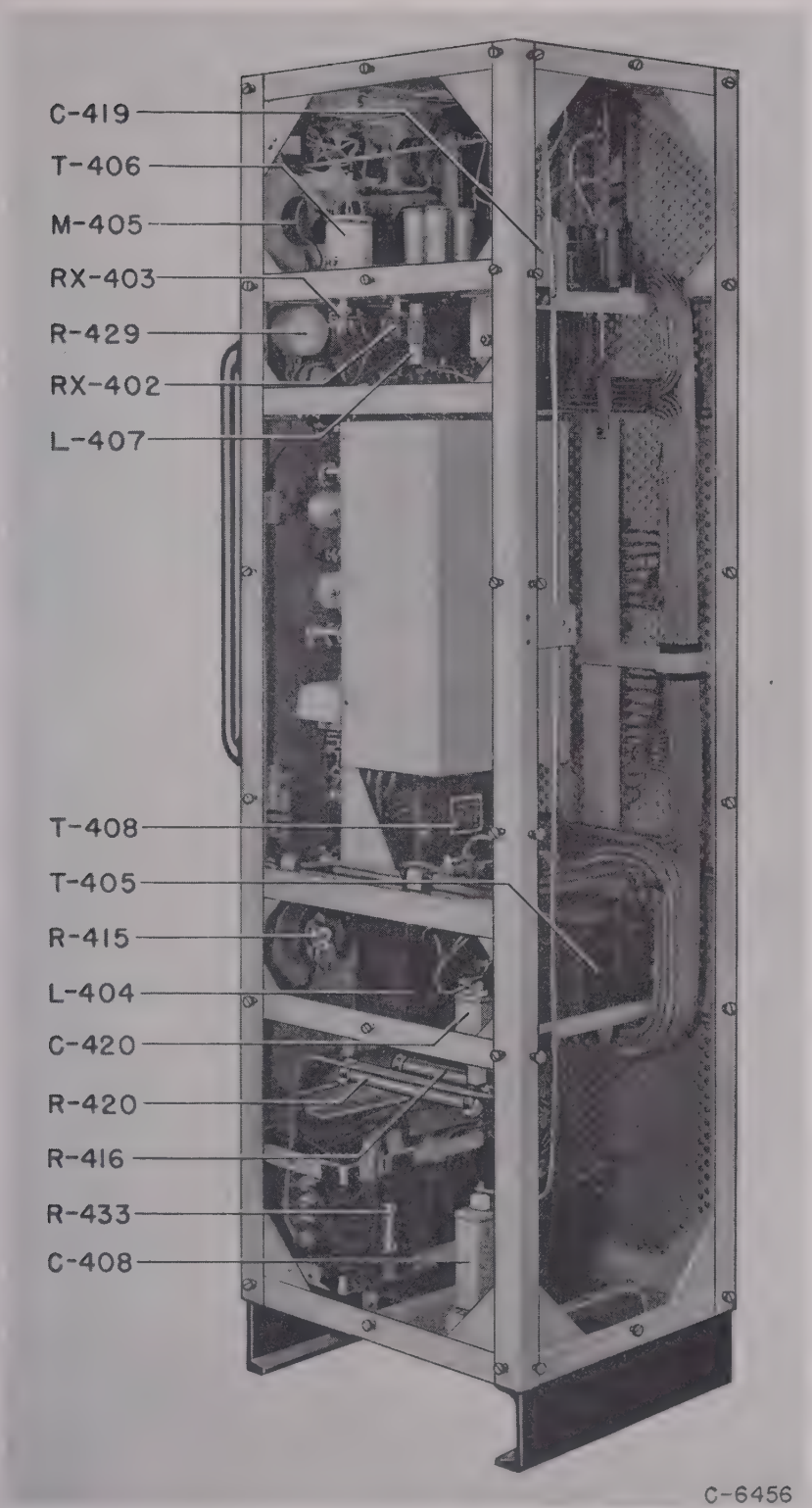


Figure 14—Modulator Unit, Navy Type CAY-50065-B, Rear Oblique of Right Side, Shields Removed (Photo C-6456)

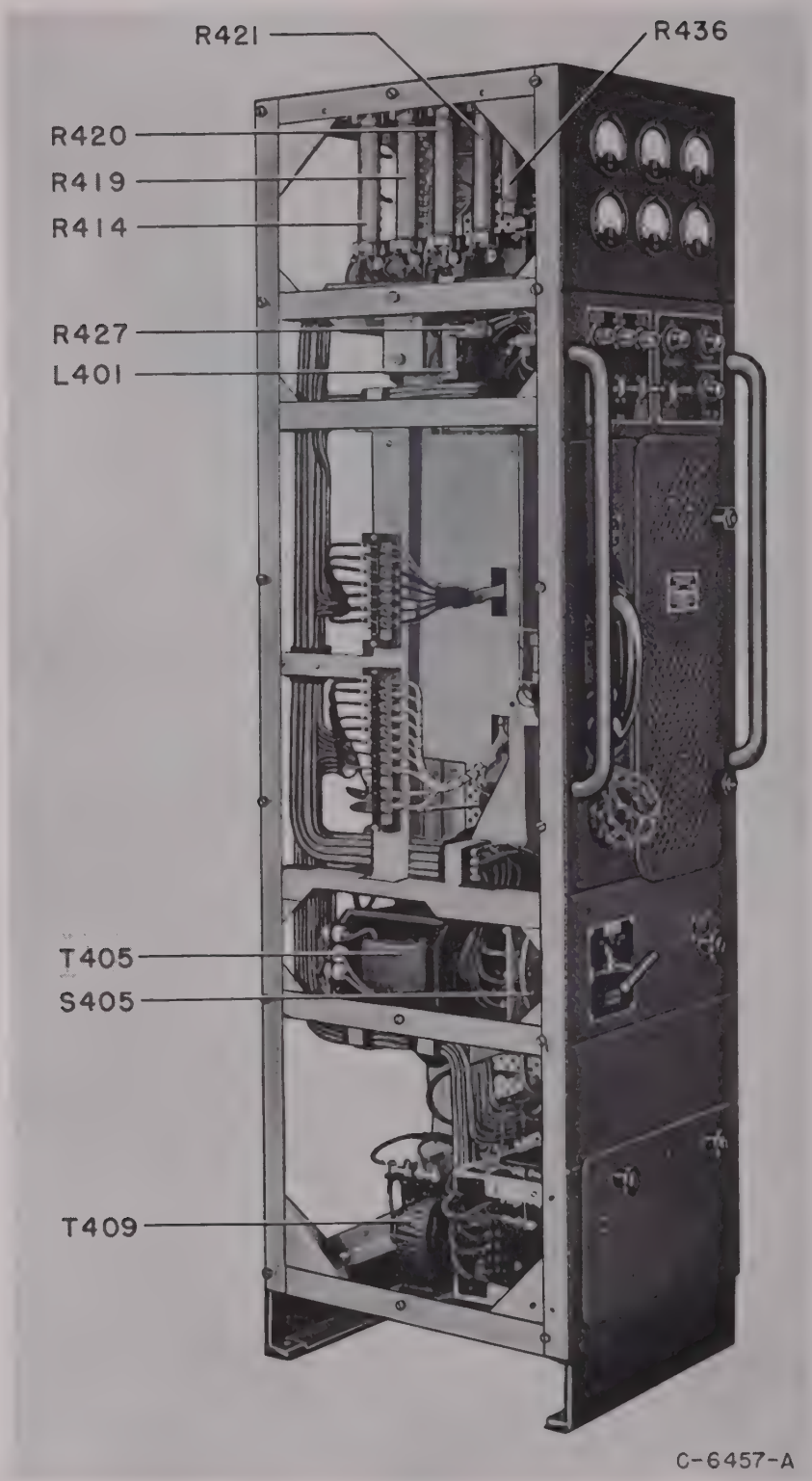


Figure 15—Modulator Unit, Navy Type CAY-50065-B, Front Oblique of Left Side, Shields Removed (Photo C-6457-A)

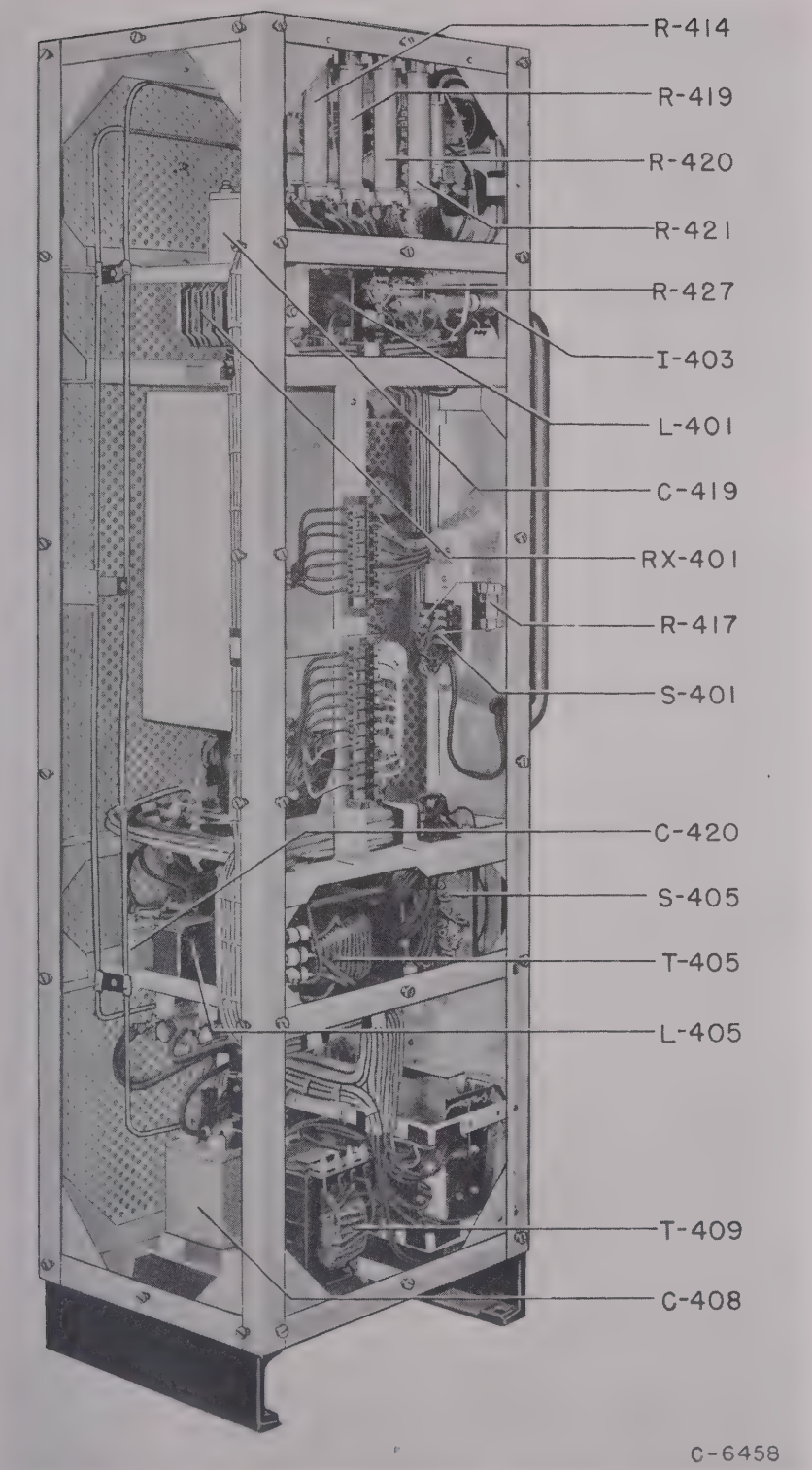


Figure 16.—Modulator Unit, Navy Type CAY-50065-B, Rear Oblique of Left Side, Shields Removed (Photo C-6458)

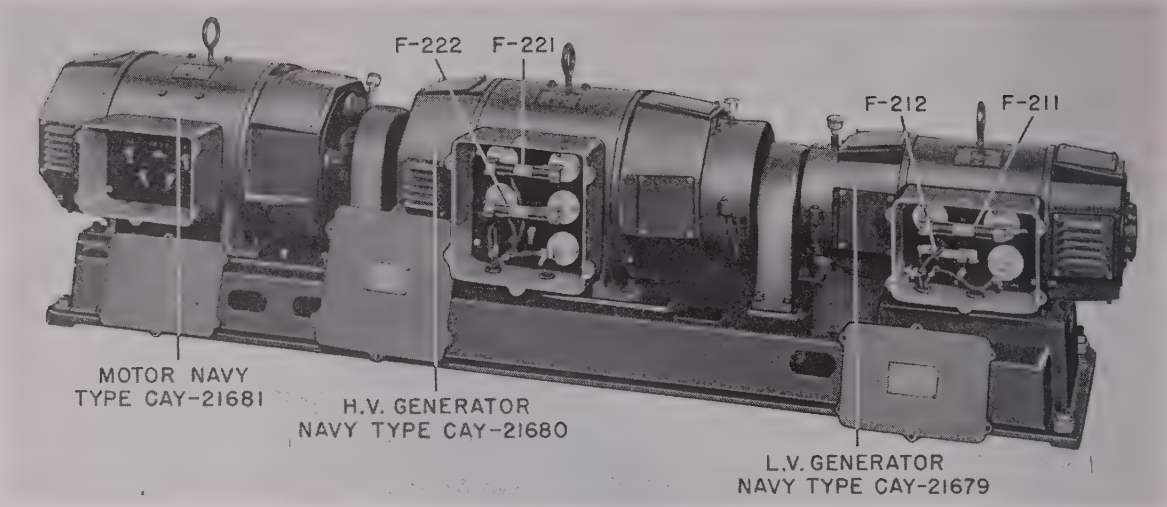


Figure 17—Motor-Generator Set, Navy Type CAY-21676, for 230 Volt D.C. Operation (Photo C-5085)

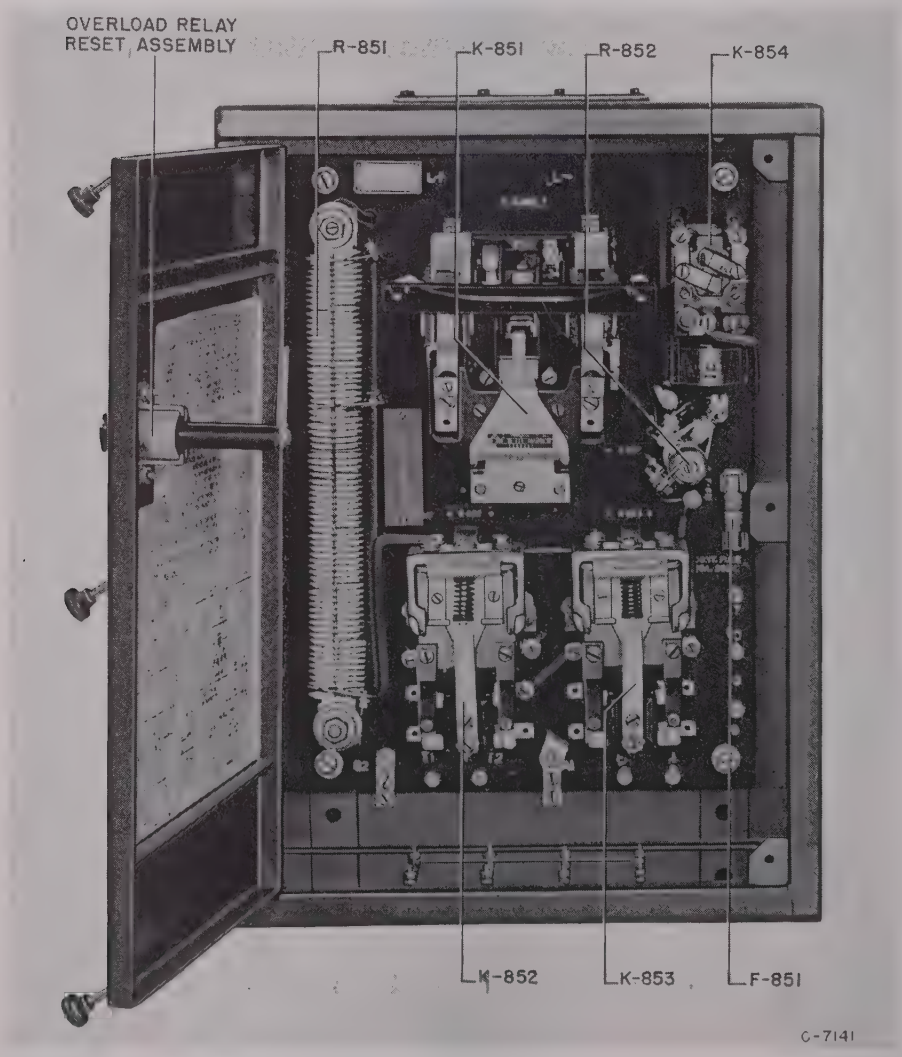
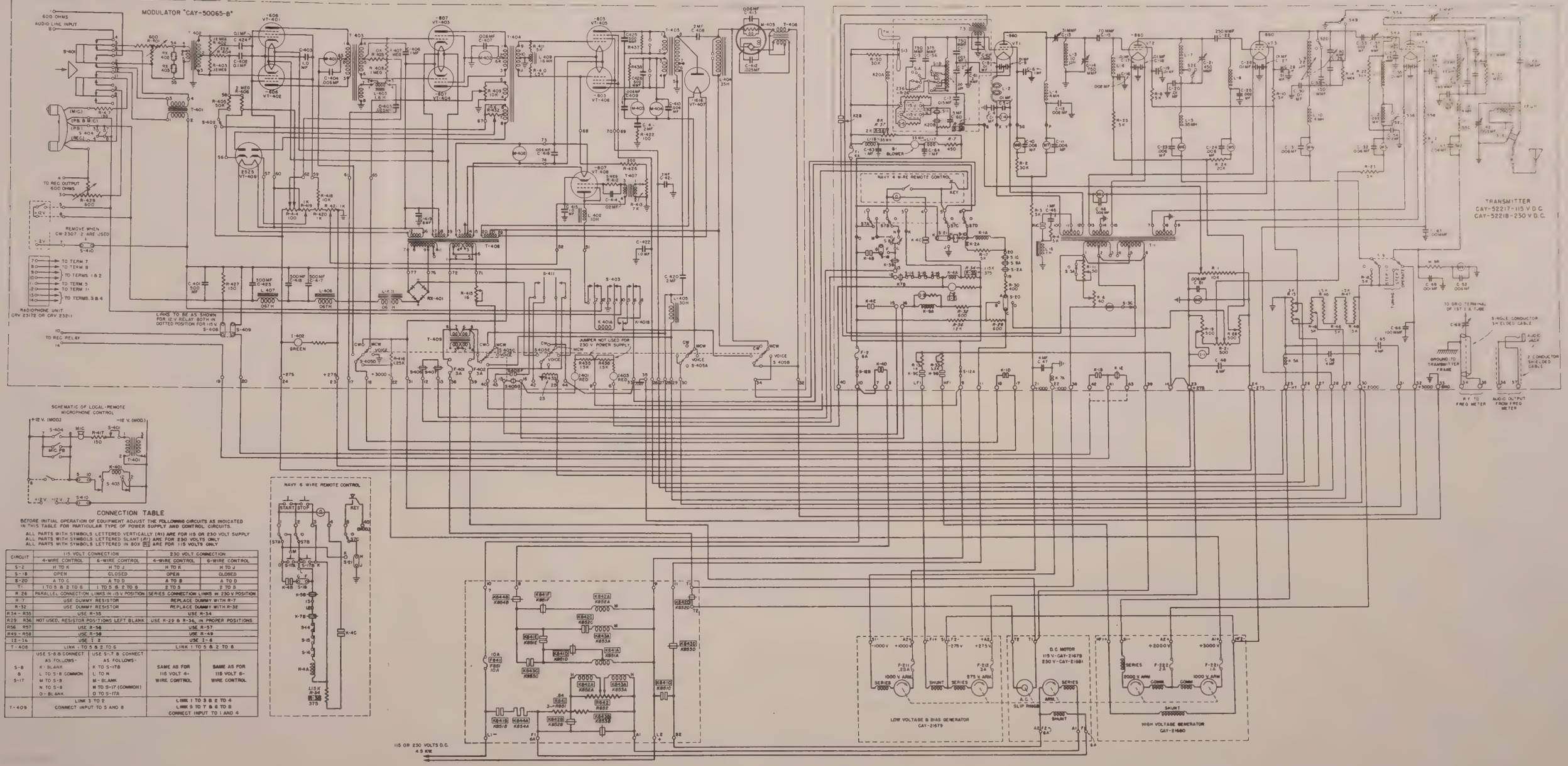


Figure 18—Magnetic Controller Unit, Navy Type 211232, for 230 Volt D.C. Operation, Door Open (Photo C-7141)


MODULATOR "CAY-50065-B"
600 OHMS AUDIO LINE INPUT
TO REC OUTPUT 600 OHMS
REMOVE WHEN CW-2307-2 ARE USED
TO TERM 7
TO TERM 8
TO TERMS 1 & 2
TO TERM 5
TO TERM 11
TO TERMS 3 & 4
RADIOPHONE UNIT CRV 23172 OR CRV 23211
TO REC RELAY
LINKS TO BE AS SHOWN FOR 12 V RELAY BOTH IN DOTTED POSITION FOR 115 V
JUMPER NOT USED FOR 230 V POWER SUPPLY
NAVY 4 WIRE REMOTE CONTROL
TRANSMITTER CAY-52217-115 V D.C. CAY-52218-230 V D.C.
TO GRID TERMINAL OF 1ST R.F. TUBE
SINGLE CONDUCTOR SHIELDED CABLE
GROUND TO TRANSMITTER FRAME
AUDIO JACK
2 CONDUCTOR SHIELDED CABLE
R-F TO FREQ METER
AUDIO OUTPUT FROM FREQ METER
SCHEMATIC OF LOCAL-REMOTE MICROPHONE CONTROL
NAVY 6 WIRE REMOTE CONTROL
115 OR 230 VOLTS D.C. 4.5 KW
LOW VOLTAGE & BIAS GENERATOR CAY-21679
A.C. SLIP RINGS
D.C. MOTOR 115 V-CAY-21678 230 V-CAY-21681
HIGH VOLTAGE GENERATOR CAY-21680

CONNECTION TABLE

BEFORE INITIAL OPERATION OF EQUIPMENT ADJUST THE FOLLOWING CIRCUITS AS INDICATED IN THIS TABLE FOR PARTICULAR TYPE OF POWER SUPPLY AND CONTROL CIRCUITS.

ALL PARTS WITH SYMBOLS LETTERED VERTICALLY (R1) ARE FOR 115 OR 230 VOLT SUPPLY
ALL PARTS WITH SYMBOLS LETTERED SLANT (R1) ARE FOR 230 VOLTS ONLY
ALL PARTS WITH SYMBOLS LETTERED IN BOX R1 ARE FOR 115 VOLTS ONLY

CIRCUIT	115 VOLT CONNECTION		230 VOLT CONNECTION	
	4-WIRE CONTROL	6-WIRE CONTROL	4-WIRE CONTROL	6-WIRE CONTROL
S-2	H TO K	H TO J	H TO K	H TO J
S-18	OPEN	CLOSED	OPEN	CLOSED
S-20	A TO C	A TO B	A TO B	A TO D
T1	1 TO 5 & 2 TO 6	1 TO 5 & 2 TO 6	2 TO 5	2 TO 5
R 26	PARALLEL CONNECTION LINKS IN 115 V POSITION		SERIES CONNECTION LINKS IN 230 V POSITION	
R-7	USE DUMMY RESISTOR		REPLACE DUMMY WITH R-7	
R-32	USE DUMMY RESISTOR		REPLACE DUMMY WITH R-32	
R34 - R35	USE R-35		USE R-34	
R29 R36	NOT USED, RESISTOR POSITIONS LEFT BLANK		USE R-29 & R-36, IN PROPER POSITIONS	
R56 R57	USE R-56		USE R-57	
R49 - R58	USE R-58		USE R-49	
12 - 16	USE 1 2		USE 1 - 6	
T-408	LINK 1 TO 5 & 2 TO 6		LINK 1 TO 5 & 2 TO 6	
S-8 & S-17	USE S-8 & CONNECT AS FOLLOWS- K - BLANK L TO S-8 COMMON M TO S-8 N TO S-8 O - BLANK	USE S-7, 8 CONNECT AS FOLLOWS- K TO S-17B L TO N M - BLANK N TO S-17 (COMMON) O TO S-17A	SAME AS FOR 115 VOLT 4-WIRE CONTROL	SAME AS FOR 115 VOLT 6-WIRE CONTROL
T-409	LINK 3 TO 2 CONNECT INPUT TO 5 AND 8		LINK 1 TO 3 & 2 TO 4 LINK 5 TO 7 & 6 TO 8 CONNECT INPUT TO 1 AND 4	

Figure 19—Schematic Diagram for Navy Model TBM-12 Radio Transmitting Equipment, Showing All Units (Dwg. W-7300875)

Figure 19—Schematic Diagram for Navy Model TBM-12 Radio Transmitting Equipment, Showing All Units (Dwg. W-7300875)

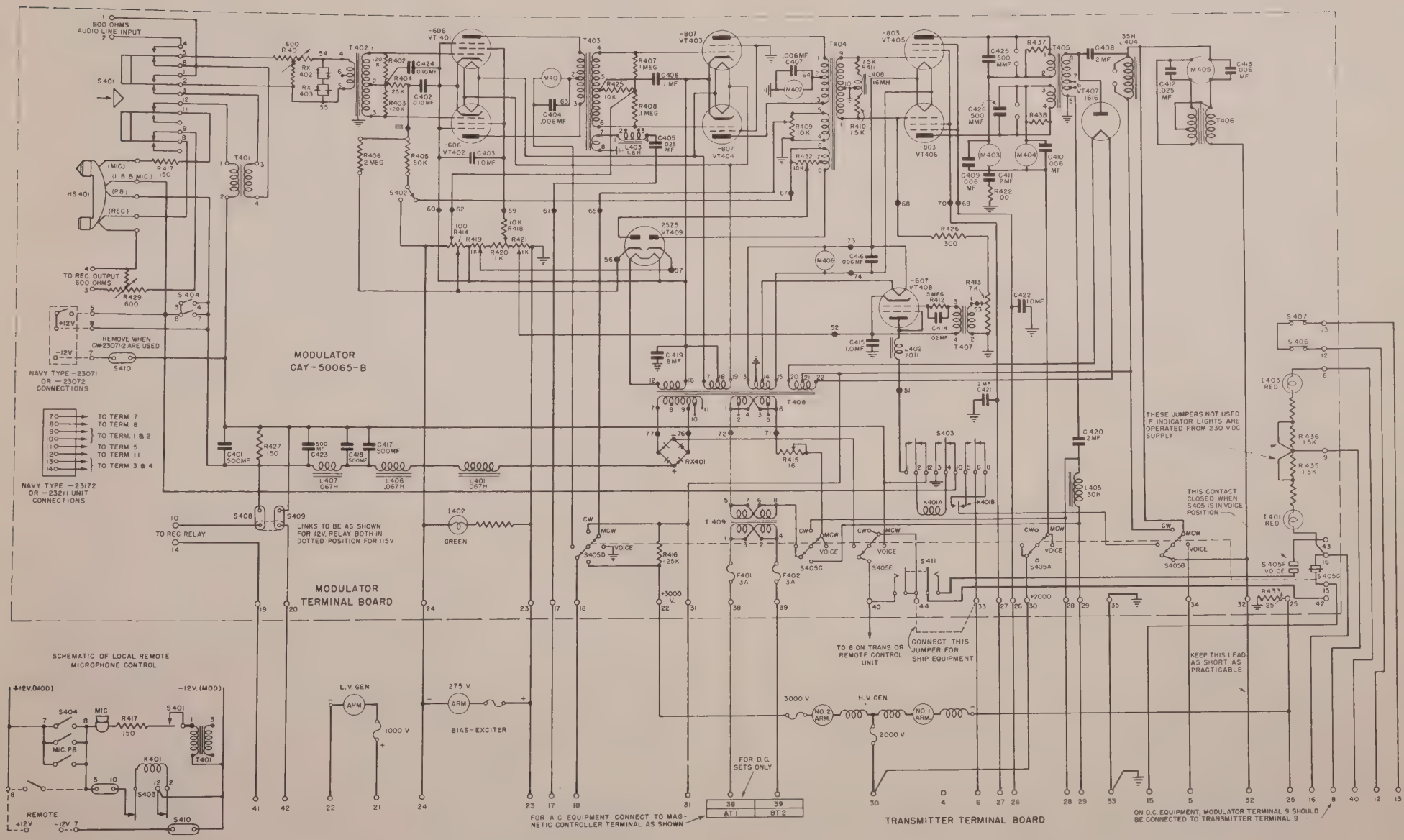


Figure 20—Schematic Diagram for Modulator Unit, Navy Type CAY-50065-B (Dwg. T-7614584)

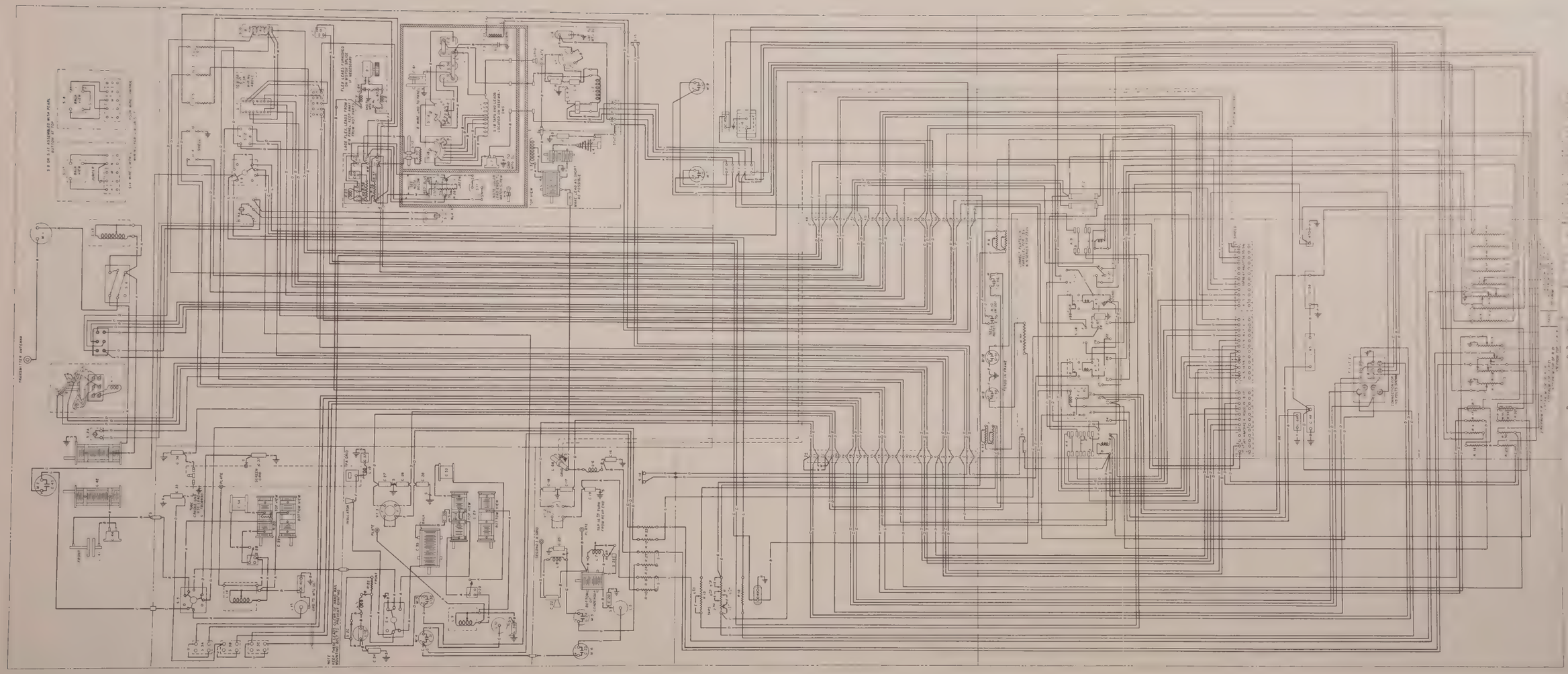


Figure 21—Wiring Diagram for Radio Transmitter Unit, Navy Type CAY-52218 (Dwg. 7300446)

Figure 21—Wiring Diagram for Radio Transmitter Unit, Navy Type CAY-52218 (Dwg. 7300446)

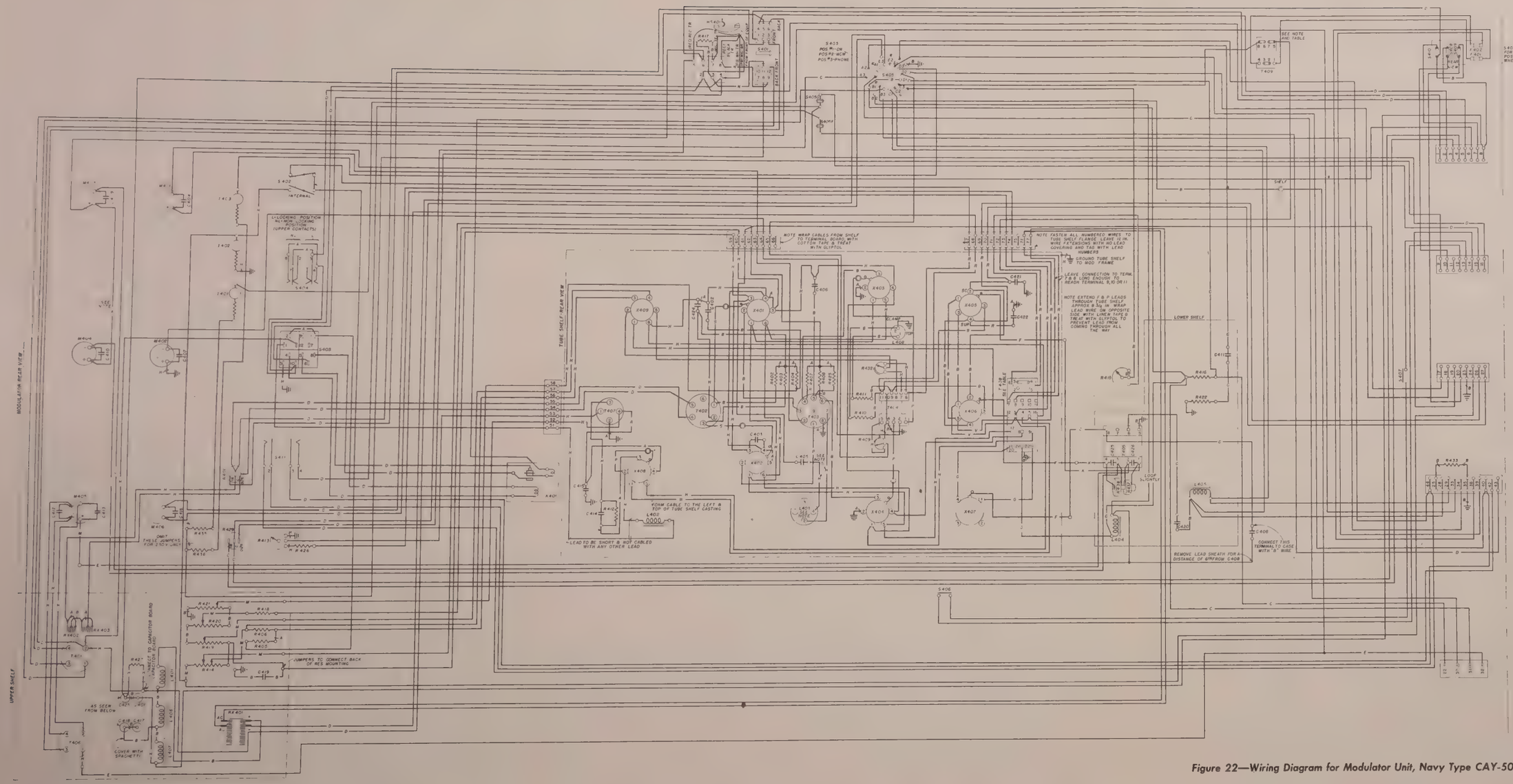
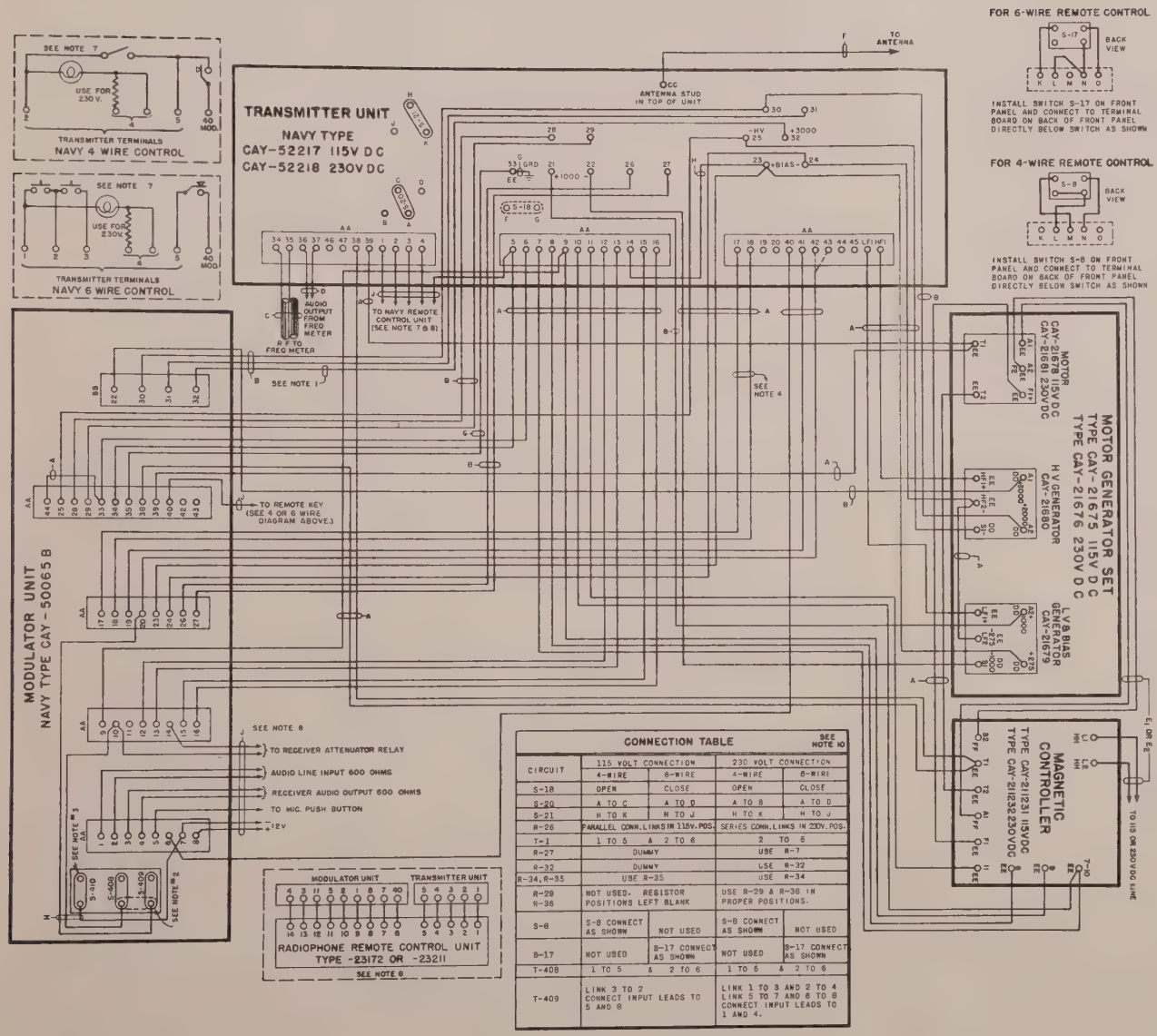

MODULATOR REAR VIEW
UPPER SHELF
TUBE SHELF-REAR VIEW
LOWER SHELF
S402 INTERNAL
L-LOCKING POSITION ALL NON-LOCKING POSITIONS (UPPER CONTACTS)
S405 POS #1-ON POS #2-MCW POS #3-PHONE
S406
S407
S408
S409
NOTE WRAP CABLES FROM SHELF TO TERMINAL BOARD WITH COTTON TAPE & TREAT WITH GLYPTOL
NOTE FASTEN ALL NUMBERED WIRES TO TUBE SHELF FLANGE LEAVE 10 IN. WIRE EXTENSIONS WITH NO LEAD COVERING AND TAG WITH LEAD NUMBERS
GROUND TUBE SHELF TO MOD FRAME
LEAVE CONNECTION TO TERM. 7 & 8 LONG ENOUGH TO REACH TERMINAL 9, 10 OR 11
NOTE EXTEND F & P LEADS THROUGH TUBE SHELF APPROX 3/4 IN WRAP LEAD WIRE ON OPPOSITE SIDE WITH LOCK TAPE & TREAT WITH GLYPTOL TO PREVENT LEAD FROM COMING THROUGH ALL THE WAY
X401
X402
X403
X404
X405
X406
X407
X408
X409
T401
T402
T403
T404
T405
T406
T407
T408
T409
L401
L402
L403
L404
L405
L406
L407
L408
L409
L410
C401
C402
C403
C404
C405
C406
C407
C408
C409
C410
C411
C412
C413
C414
C415
C416
C417
C418
C419
C420
C421
C422
C423
C424
C425
C426
C427
C428
C429
C430
C431
C432
C433
C434
C435
C436
C437
C438
C439
C440

Figure 22—Wiring Diagram for Modulator Unit, Navy Type CAY-50065-B (Dwg. 7300869)

RESTRICTED


TRANSMITTER UNIT
NAVY TYPE
CAY-52217 115V DC
CAY-52218 230V DC
MODULATOR UNIT
NAVY TYPE CAY-50065 B
MOTOR GENERATOR SET
TYPE CAY-21675 115V D C
TYPE CAY-21676 230V D C
MAGNETIC CONTROLLER
TYPE CAY-21123 115VDC
TYPE CAY-21232 230VDC
RADIOPHONE REMOTE CONTROL UNIT
TYPE -23172 OR -23211
TRANSMITTER TERMINALS
NAVY 4 WIRE CONTROL
TRANSMITTER TERMINALS
NAVY 6 WIRE CONTROL
FOR 6-WIRE REMOTE CONTROL
FOR 4-WIRE REMOTE CONTROL
TO ANTENNA
ANTENNA STUD IN TOP OF UNIT
TO REMOTE KEY (SEE 4 OR 6 WIRE DIAGRAM ABOVE.)
TO RECEIVER ATTENUATOR RELAY
AUDIO LINE INPUT 600 OHMS
RECEIVER AUDIO OUTPUT 600 OHMS
TO MIC. PUSH BUTTON
+12V
TO NAVY REMOTE CONTROL UNIT (SEE NOTE 7 & 8)
R F TO FREQ METER
AUDIO OUTPUT FROM FREQ METER
TO 115 OR 230 V DC LINE

CONNECTION TABLE					SEE NOTE 10
CIRCUIT	115 VOLT CONNECTION		230 VOLT CONNECTION		
	4-WIRE	6-WIRE	4-WIRE	6-WIRE	
S-18	OPEN	CLOSE	OPEN	CLOSE	
S-20	A TO C	A TO D	A TO B	A TO D	
S-21	H TO K	H TO J	H TO K	H TO J	
R-26	PARALLEL CONN. LINKS IN 115v. POS.		SERIES CONN. LINKS IN 230V. POS.		
T-1	1 TO 5 & 2 TO 6		2 TO 5		
R-27	DUMMY		USE R-7		
R-32	DUMMY		USE R-32		
R-34, R-35	USE R-35		USE R-34		
R-29 R-36	NOT USED- RESISTOR POSITIONS LEFT BLANK		USE R-29 & R-36 IN PROPER POSITIONS.		
S-8	S-8 CONNECT AS SHOWN	NOT USED	S-8 CONNECT AS SHOWN	NOT USED	
S-17	NOT USED	S-17 CONNECT AS SHOWN	NOT USED	S-17 CONNECT AS SHOWN	
T-408	1 TO 5 & 2 TO 6		1 TO 5 & 2 TO 6		
T-409	LINK 3 TO 2 CONNECT INPUT LEADS TO 5 AND 8		LINK 1 TO 3 AND 2 TO 4 LINK 5 TO 7 AND 6 TO 8 CONNECT INPUT LEADS TO 1 AND 4.		

ANTENNA DATA

MAXIMUM LENGTH OF ANTENNA	80 FT.
MAXIMUM LENGTH OF TRUNK	35 FT.
MINIMUM LENGTH OF TRUNK	NONE
DIAMETER OF TRUNK	8 TO 12 INCHES
MAXIMUM DISTANCE TO ENTERING INSULATOR	20 FT.
MINIMUM DISTANCE TO ENTERING INSULATOR	2 FT.
CAPACITY 500 TO 1000 MMFD.	RESISTANCE (R.F.) 6 TO 30 OHMS

POWER REQUIREMENTS

POWER SUPPLY	115 OR 230 V.D.C. (SEE NOTE #9)			
ALLOWABLE VARIATION IN LINE VOLTAGE	10%			
RATED H.P. OF MOTOR	5 AT 1800 R.P.M.			
	LINE AMPERES		KILOWATTS REQUIRED FROM LINE	
CONDITION	115V.	230V.	115V.	230V.
STARTING	87	43	10	10
LOCKED KEY	37.4	18.7	4.3	4.3
STANDBY	23.6	12.2	2.7	2.8

WIRE LEGEND								
SYMBOL	CONDUCTOR SIZE CIRCULAR MILS	ALLOWABLE DROP	CURRENT RATING	VOLTAGE RATING	TYPE INSULATION	COMMERICAL DESIGNATION	NAVY DESIGNATION	NOTES
A	4,494		25	1000	ASBESTOS		SHFA-4	
B	4,494		25	5000	ASBESTOS		SHFR-4	
C	1,758		3	3500	SYN. RESIN		AN-RO-12/U	
D	2,828		8	1000	ASBESTOS		DHFA-3	
E_1	59,940	3% OF LINE VOLTAGE	160	1000	ASBESTOS		DHFA-80	5
E_2	14,350	3% OF LINE VOLTAGE	65	1000	ASBESTOS		DHFA-14	5
F	3/8" TO 1/2" DIA.				NONE			COPPER TUBING
G	1" WIDE X 1/32" TK.				NONE			SEE 11 COPPER STRAP
H								PART OF ASSEMBLY
J	2,828		8	1000	ASBESTOS		MHFA-	7 & 8

TERMINAL DESIGNATION			
SYMBOL	DESCRIPTION	SIZE OF TERMINAL STUD OR SCREW	NOTES
AA	MOLDED TERMINAL STRIP	10 - 32	
BB	CERAMIC LEAD-THRU BUSHINGS IN LAMINATED PHENOLIC BOARD	10 - 32	6
CC	STUD ON STAND-OFF-INSULATOR IN TOP SECTION OF TRANSMITTER	1/4 - 20	
DD	SCREW IN EAR ON FUSE CLIP	10 - 32	
EE	STUD IN LAMINATED PHENOLIC BOARD	10 - 32	
FF	SCREW IN CONNECTION STRAP	1/4 - 20	
GG	STUD IN LAMINATED PHENOLIC BOARD	1/4 - 20	
HH	CONNECTION STUD ON CONTACTOR	1/4 - 20	

NOTES

1. THIS LEAD TO BE AS SHORT AS PRACTICAL. FOR GOOD RESULTS NOT TO EXCEED FIVE FEET.
2. LINKS TO BE IN POSITION SHOWN FOR OPERATING 12V. RELAY, AND BOTH IN DOTTED POSITION FOR 115V. RELAY.
3. REMOVE LINK IF REMOTE RADIO PHONE UNIT TYPE-23071 OR -23072 IS CONNECTED.
4. THESE LEADS ARE TO BE RUN IN SEPERATE CONDUIT.
5. SIZE OF WIRE CALCULATED FOR MAXIMUM DISTANCE OF 400 FT. ALLOWING 3% DROP IN LINE VOLTAGE IN LEADS. IF DISTANCE FROM VOLTAGE SOURCE IS GREATER THAN 400 FT. ADVISE USE OF WIRE SIZE TO GIVE A 3% DROP IN LINE. MINIMUM ALLOWABLE VOLTAGE AT MOTOR TERMINALS IS NOMINAL LINE VOLTAGE MINUS 10%. USE E_1 WIRE FOR 115 V.D.C. SUPPLY AND E_2 WIRE FOR 230 V.D.C. SUPPLY.
6. TERMINALS SHOWN IN TRANSMITTER UNIT NOT MARKED WITH TERMINAL DESIGNATION SYMBOL ARE "BB" TERMINALS.
7. NAVY 4— OR 6— WIRE CONTROL UNITS NOT SUPPLIED ON CONTRACT AS PART OF EQUIPMENT. TYPE MHFA- WIRE FOR CONNECTION TO THESE TERMINALS SUPPLIED AS PART OF REMOTE CONTROL UNIT.
8. NAVY TYPE -28172, -23211, -23071, OR -23072 NOT SUPPLIED ON CONTRACT AS PART OF EQUIPMENT. CONNECTIONS TO TYPE -23172 OR -23211 SHOWN IN INSET. CONNECTIONS TO TYPE -23071 SHOWN ON DRAWING M-7417689 AND TO TYPE -28072 ON DRAWING M-7417690. TYPE MHFA - WIRE FOR CONNECTIONS TO THESE UNITS SUPPLIED AS PART OF REMOTE CONTROL EQUIPMENT AND NOT ON CONTRACT FOR TBM-12
9. FOR 115V. D.C. SUPPLY EQUIPMENT CONSISTS OF TRANSMITTER UNIT CAY-52217, MODULATOR UNIT CAY-50065-B MOTOR GENERATOR SET CAY-21675, AND MAGNETIC CONTROLLER CAY-211231. FOR 230 V.D.C. SUPPLY EQUIPMENT CONSISTS OF TRANSMITTER UNIT CAY-52218, MODULATOR UNIT CAY-50065-B MOTOR GENERATOR SET CAY-21676, AND MAGNETIC CONTROLLER CAY-211232.
10. BEFORE INITIAL OPERATION OF EQUIPMENT CONNECT CIRCUITS AS INDICATED IN CONNECTION TABLE FOR PARTICULAR TYPE OF POWER AND CONTROL CIRCUITS.
11. FRAME OF M-G SET AND CASE OF MAGNETIC CONTROLLER ARE TO BE BONDED TO TRANSMITTER FRAME BY G WIRE.

Figure 23—Interconnection Diagram for Navy Model TBM-12 Radio Transmitting Equipment (Dwg. T-7614583)

RESTRICTED

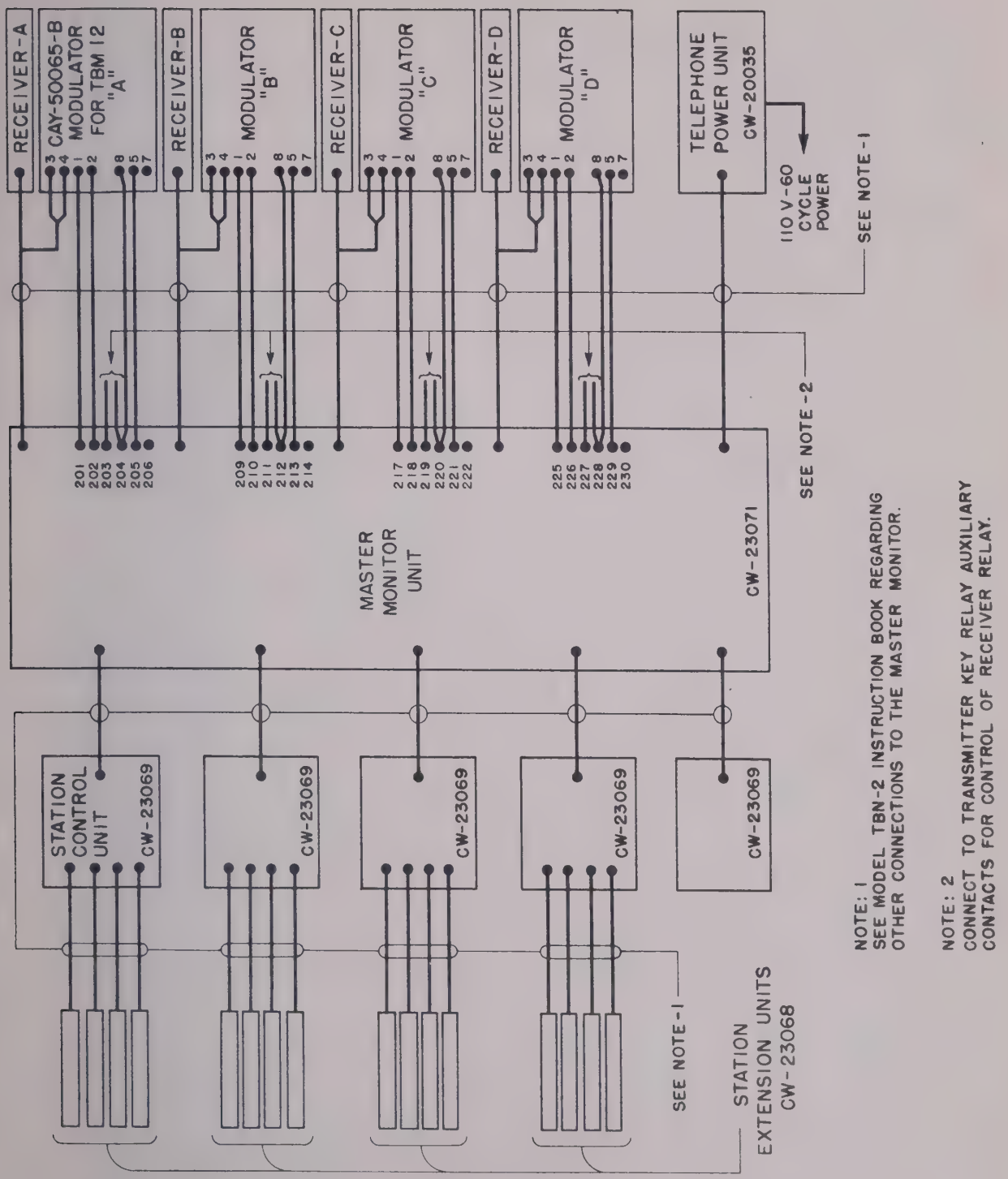
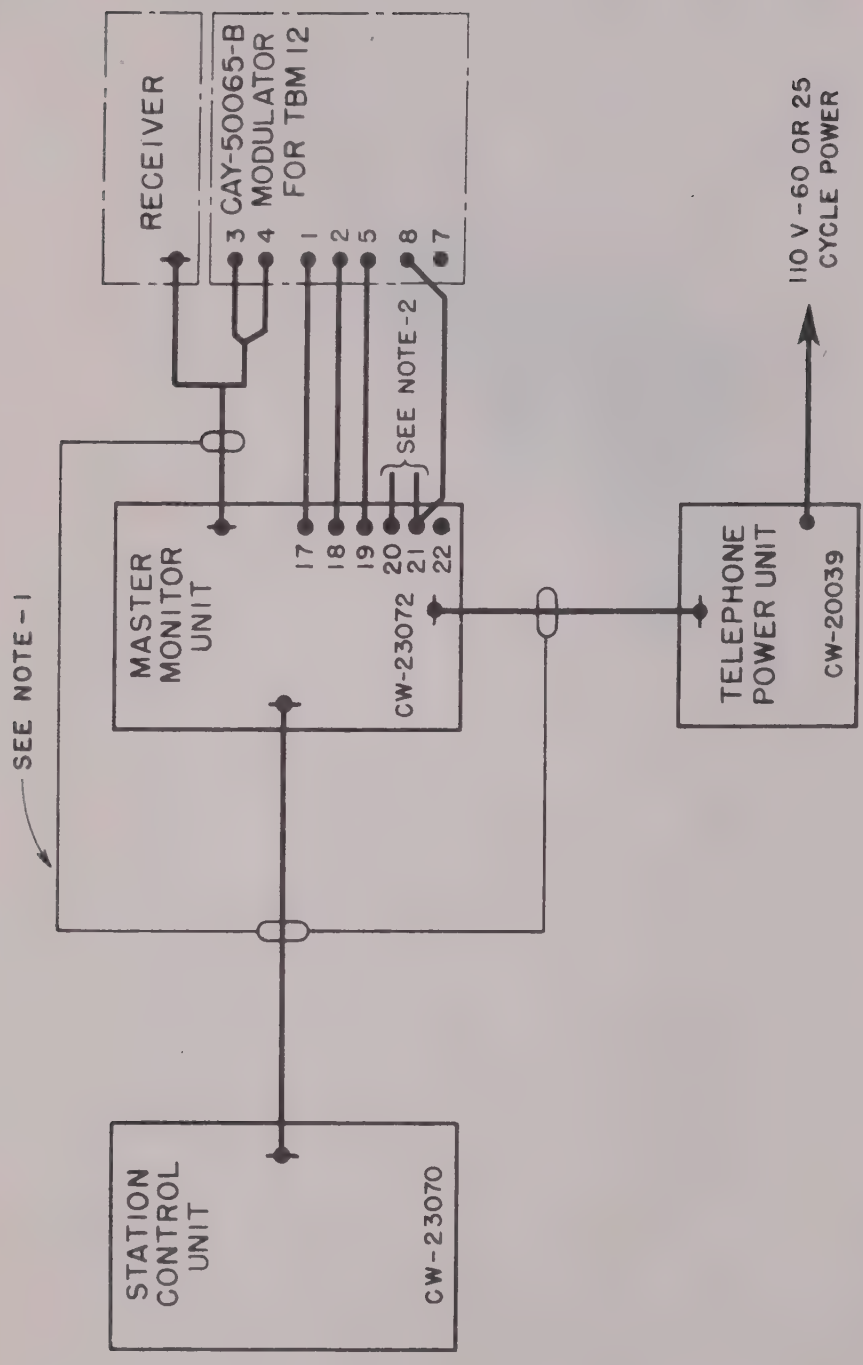


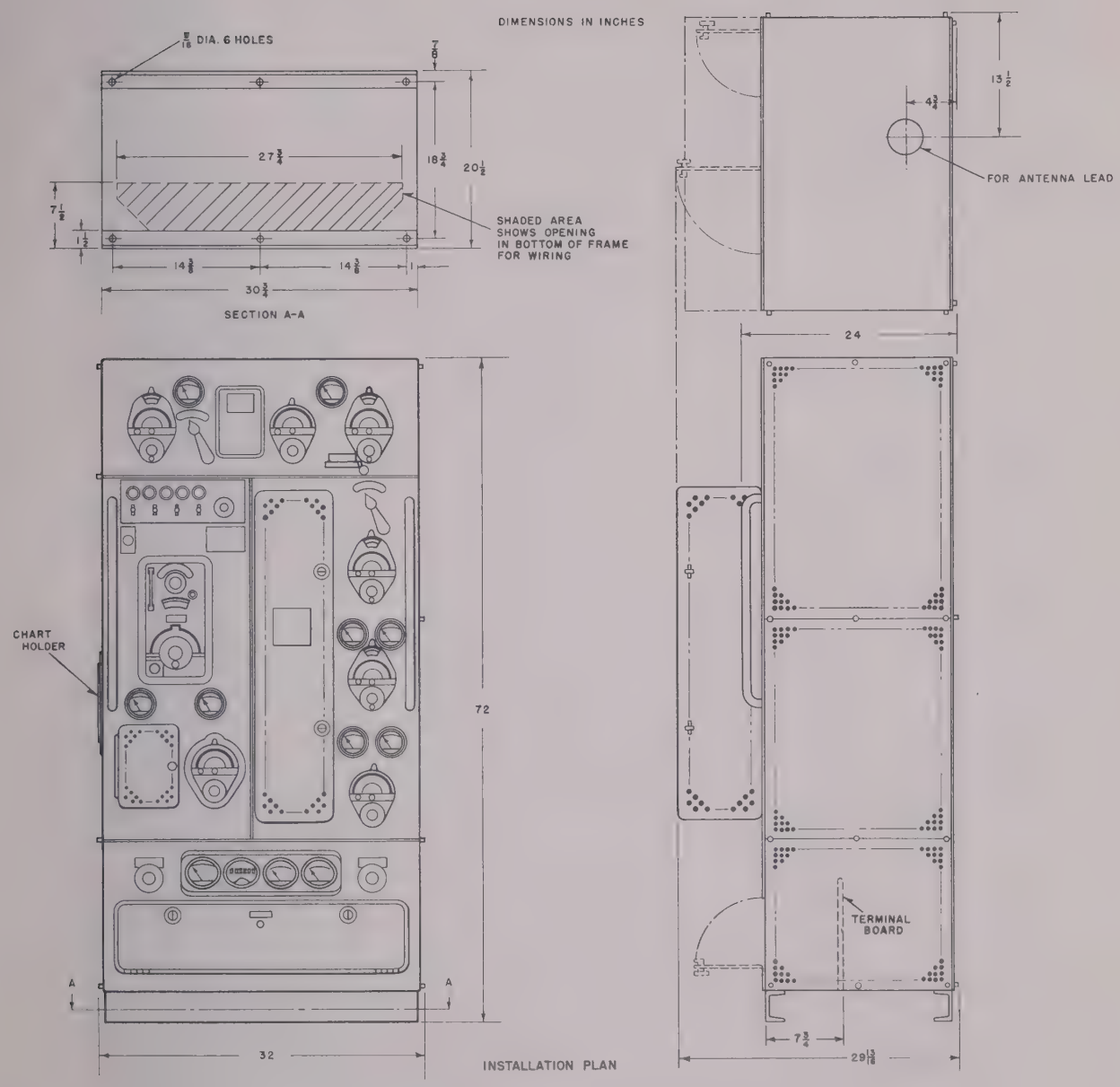
Figure 24—Interconnection Diagram for Navy Model TBM-12 Radio Transmitting Equipment with Navy Type CW-23071 Master Monitor (Dwg. M-7417689)



NOTE: 1
SEE MODEL TBN-3 INSTRUCTION BOOK REGARDING OTHER CONNECTIONS TO THE MASTER MONITOR.

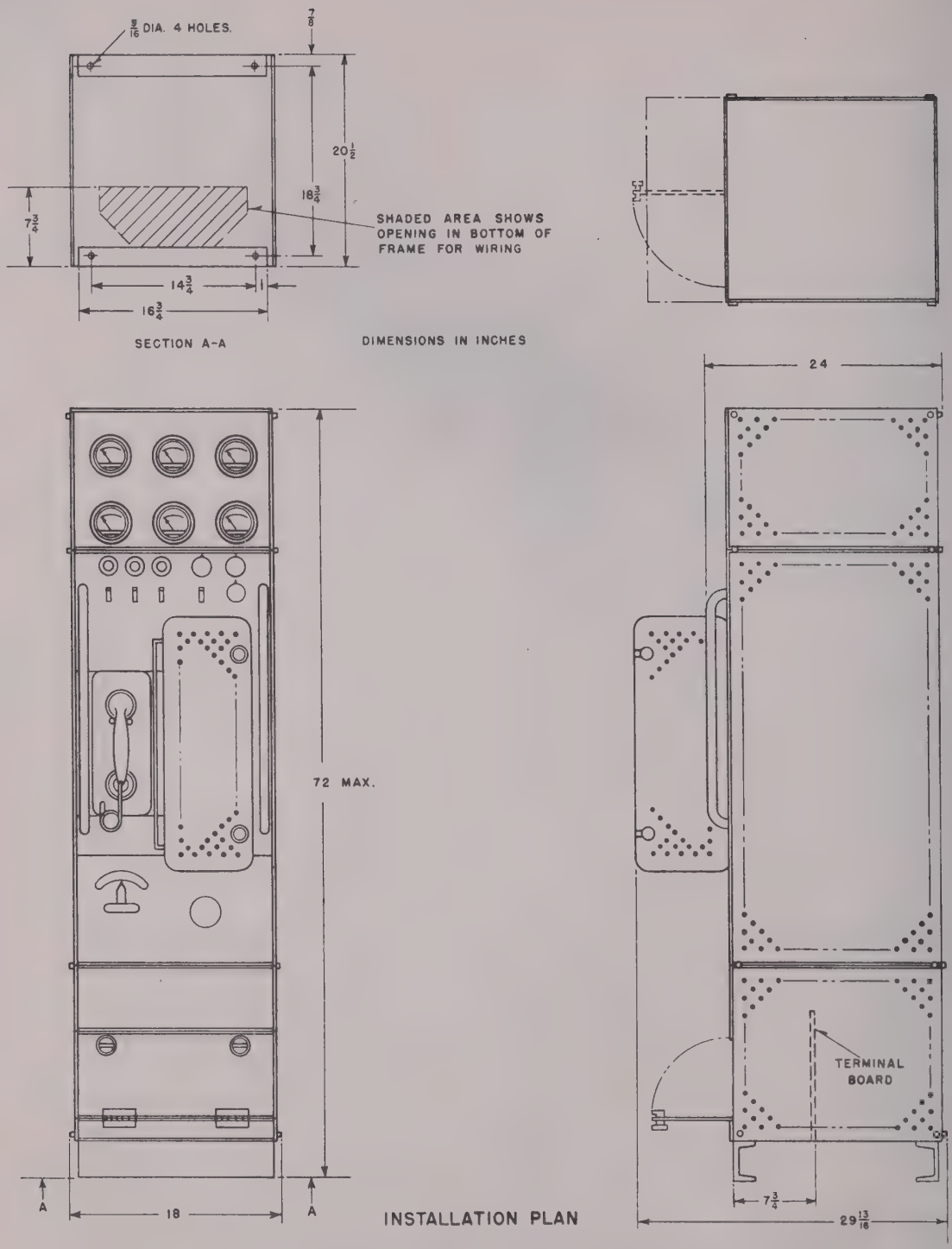
NOTE: 2
CONNECTION TO TRANSMITTER KEY RELAY AUXILIARY CONTACTS FOR CONTROL OF RECEIVER RELAY.

Figure 25—Interconnection Diagram for Navy Model TBM-12 Radio Transmitting Equipment with Navy Type CW-23072 Master Monitor (Dwg. M-7417690)



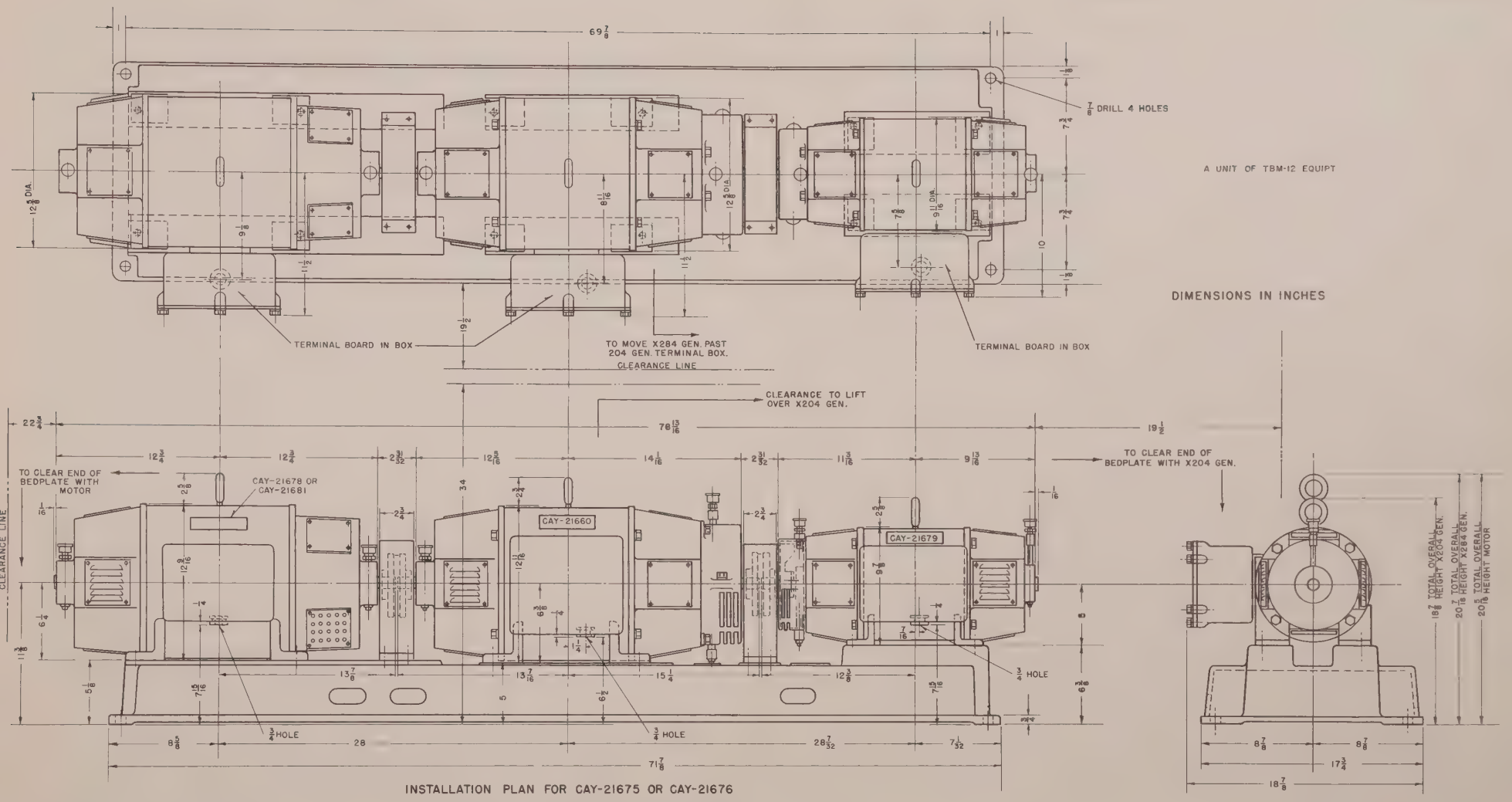
NAVY TYPE NO.	WEIGHT (POUNDS) CRATED	WEIGHT (POUNDS) UNCRATED	CUBICAL CONTENT (CU. FT.) CRATED
CAY- 52217	1000	740	53.0
CAY- 52218	1035	780	53.0
CAY- 52170	1035	780	53.0
CAY- 52171	1035	780	53.0

Figure 26—Outline and Mounting Dimensions for Navy Type CAY-52218 Radio Transmitter Unit (Dwg. T-7611719)



WEIGHT (POUNDS)		CUBICAL CONTENT (CU. FT.)
UNCRATED	CRATED	CRATED
385	580	34.4

Figure 27—Outline and Mounting Dimensions for Navy Type CAY-50065-B Modulator Unit (Dwg. P-7714933)

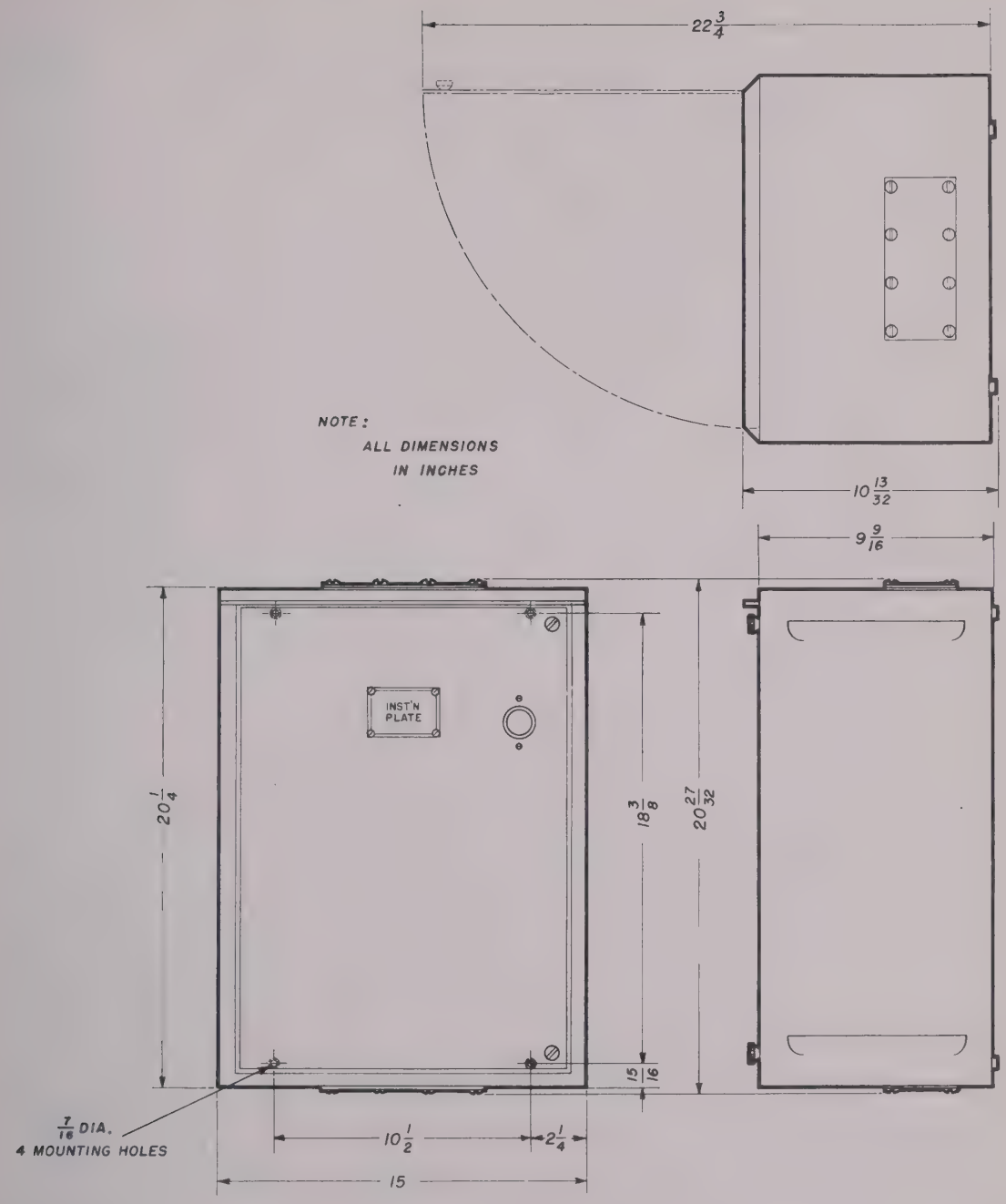

A UNIT OF TBM-12 EQUIPT
DIMENSIONS IN INCHES
7/8 DRILL 4 HOLES
TERMINAL BOARD IN BOX
TO MOVE X284 GEN. PAST 204 GEN. TERMINAL BOX.
CLEARANCE LINE
CLEARANCE TO LIFT OVER X204 GEN.
TERMINAL BOARD IN BOX
TO CLEAR END OF BEDPLATE WITH MOTOR
CAY-21678 OR CAY-21681
CAY-21660
CAY-21679
TO CLEAR END OF BEDPLATE WITH X204 GEN.
3/4 HOLE
3/4 HOLE
3/4 HOLE
18 3/4 TOTAL OVERALL HEIGHT X204 GEN.
20 7/16 TOTAL OVERALL HEIGHT X284 GEN.
20 5/8 TOTAL OVERALL HEIGHT MOTOR

INSTALLATION PLAN FOR CAY-21675 OR CAY-21676

MG SET	CONSISTING OF	WEIGHT (POUNDS) CRATED	WEIGHT (POUNDS) UNCRATED	CUBICAL CONTENT (CU. FT.) CRATED
CAY-21675	CAY-21678 115V D.C. MOTOR CAY-21679 L.V. & BIAS D.C. GENERATOR CAY-21680 H.V. D.C. GENERATOR	1475	1225	34.7
CAY-21676	CAY-21681 230V D.C. MOTOR CAY-21679 L.V. & BIAS D.C. GENERATOR CAY-21680 H.V. D.C. GENERATOR	1475	1225	34.7

NAVY TYPE CAY-21678 D.C. MOTOR SK-X259-4/2 POLE-5HP.-1800 R.P.M. 115VOLTS 44 AMPS.
NAVY TYPE CAY-21681 D.C. MOTOR SK-X254-4/2 POLE-5HP.-1800 R.P.M. 230VOLTS 22 AMPS.
NAVY TYPE CAY-21680 GENERATOR SK-X284-2/2 POLE-1.05/1.5 KW. 1800 R.P.M. 3000/2000 VOLTS D.C.-.35/.75 AMPS.
NAVY TYPE CAY-21679 GENERATOR SK-X204-2 POLE-.075/.253 KW 1800 R.P.M. 1000/275 VOLTS D.C-.075/.92 AMPS.

Figure 28—Outline and Mounting Dimensions for Navy Type CAY-21676 Motor-Generator Set (Dwg. T-7611738)



INSTALLATION PLAN

NAVY TYPE NUMBER	WEIGHT (POUNDS) CRATED	UNCRATED	CUBICAL CONTENT (CU.FT.) CRATED
CAY-211231	123	68	7.0
CAY-211232		76	

Figure 29—Outline and Mounting Dimensions for Navy Type CAY-211232 Magnetic Controller Unit (Dwg. P-7713319)

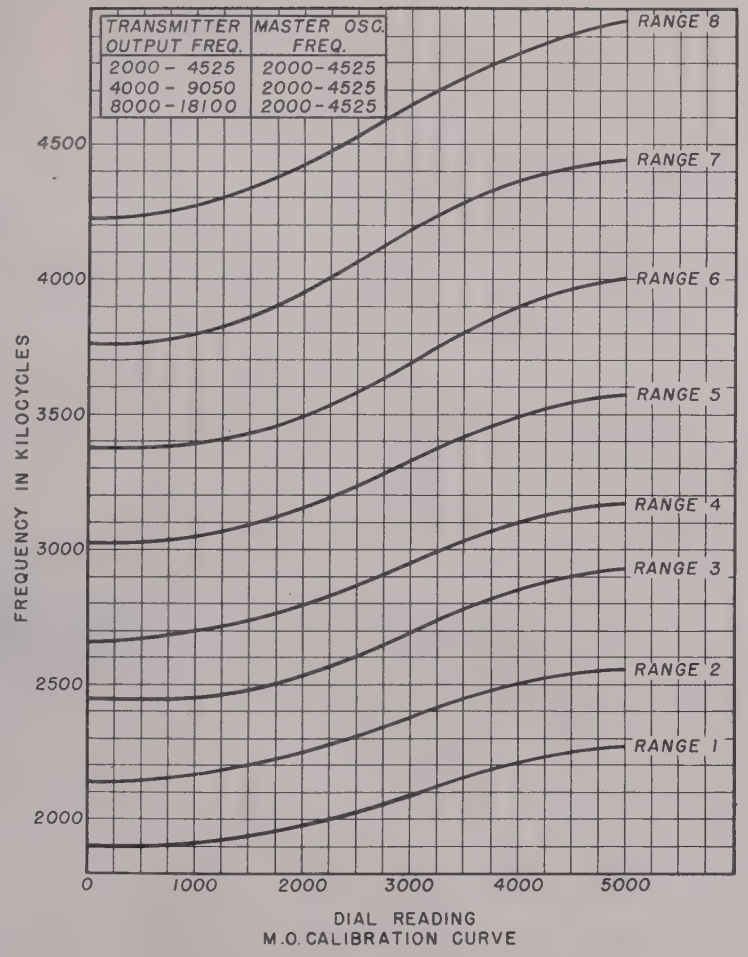


Figure 30—Tuning Curve for Master Oscillator, Controls A and B (Curve 226373)

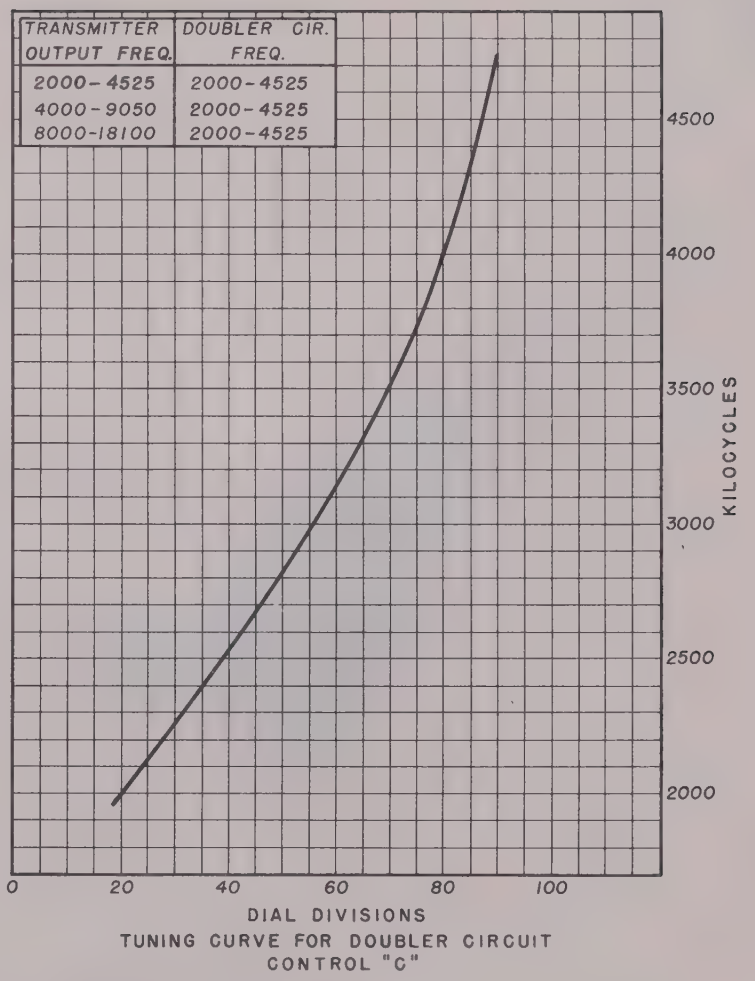


Figure 31—Tuning Curve for Doubler Circuit, Control C (Curve 218634)

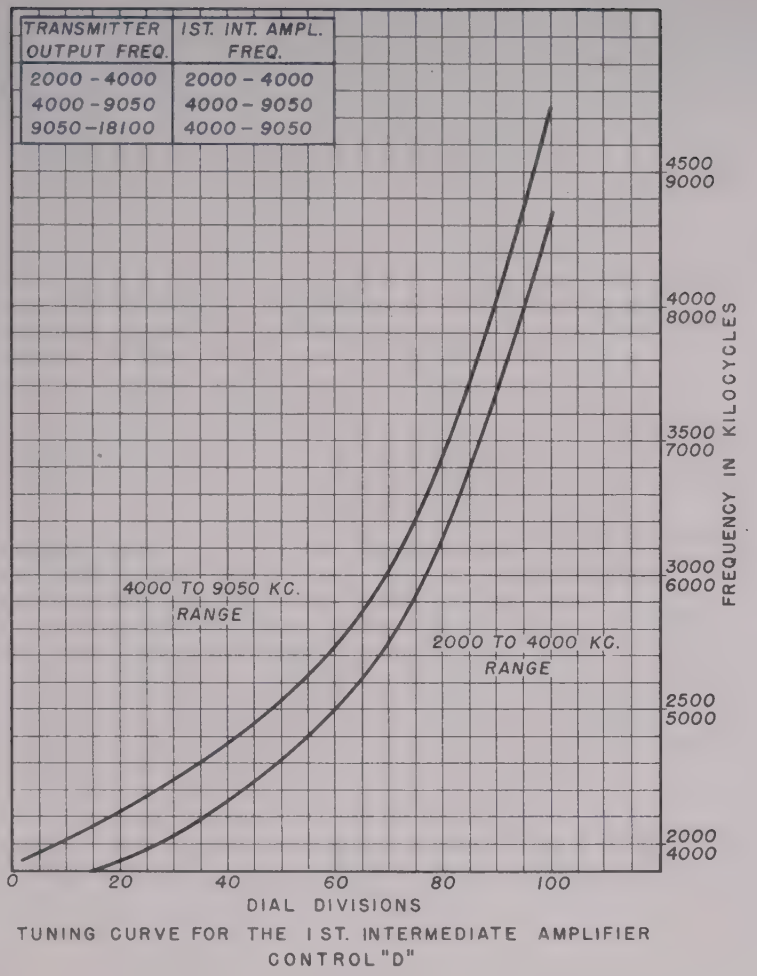


Figure 32—Tuning Curve for First Intermediate Amplifier, Control D (Curve 218636)

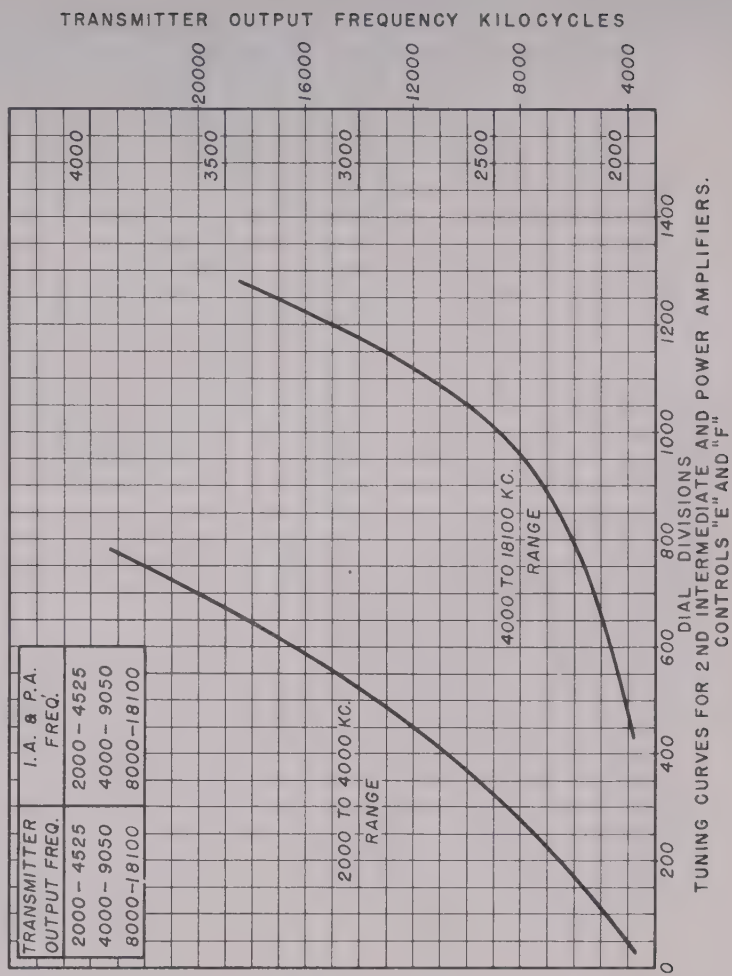


Figure 33—Tuning Curve for Second Intermediate Amplifier and Power Amplifier, Controls E and F (Curve 218635)

TABLE OF TYPICAL METER READINGS

Freq. Kcs.	Power Range	Antenna Constants	M Isg M.A.	O Ip M.A.	1st I.A. Ip M.A.	2nd I.A. Ig M.A.	2nd I.A. Ip M.A.	P.A.		Voltages			Antenna			
								Ig M.A.	Ip M.A.	Ep V.	Eg V.	Ef AC V.	I Int. Amp.	I Ext. Amp.	Watts	Guar. Watts
2000	High	C = 1000 R = 6.098	14.5	49	38	25	61	71	350	2930	246	10	10.0	9.9	598	500
	Low	1000 6.098	14.5	49	53	33	150	....	....	3040	240	10	4.8	4.78	138	75
3000	High	Inf. 29.18	10.5	63	59	41	87	37	350	2910	242	10	4.2	4.7	645	500
3500	High	Inf. 18.98 Type C	9	63	58	44	88	27	350	2910	240	10	4.8	5.2	514	475
4000	High	110 V. — 500 W. Lamp	9	74	66	27	48	52	350	2910	243	10	....	....	560	475
	Low	32 V. — 75 W. Lamp	9	75	88	22	125	....	....	3020	240	10	....	....	120	75
4500	High	110 V. — 500 W. Lamp	9	72	67	28	79	59	350	2910	243	10	....	....	610	450
6000	High	110 V. — 500 W. Lamp	10	62	63	24	72	37	350	2890	239	10	....	....	540	450
	Low	32 V. — 75 W. Lamp	10.5	62	79	25	125	....	....	3030	237	10	....	....	120	75
7500	High	110 V. — 500 W. Lamp	9	73	76	39	96	34	350	2910	238	10	....	....	515	400
	Low	32 V. — 75 W. Lamp	9	74	88	30	125	....	....	3020	236	10	....	....	120	65
9050	High	110 V. — 500 W. Lamp	9	71	70	29	87	31	350	2990	238	10	....	....	490	375
	Low	32 V. — 75 W. Lamp	9	72	80	28	125	....	....	3010	236	10	....	....	120	60
12000	High	110 V. — 500 W. Lamp	10.5	63	60	20	68	38	350	2890	240	10	....	....	480	360
16000	High	110 V. — 500 W. Lamp	9	72	65	26	83	47	350	2890	241	10	....	....	375	325
18100	High	110 V. — 500 W. Lamp	8.5	72	60	24	90	44	350	2890	239	10	....	....	340	300

Figure 34—Table of Typical Meter Readings

TABLE OF TYPICAL DIAL AND TAP SETTINGS

Freq. Kcs.	Power Range	Antenna Constants	A	B	C	D	E	F	G	H	J	K	L
2000	High	C = 1000 R = 6.098	1	2081	18	26	053	059	Curr.	975	15	0	
	Low	1000 6.098	1	2081	18	26	019	.....	Curr.	776	13	0	2000
3000	High	Inf. 29.18	4	3313	54	76	517	511	Volt	1409	26	080	4000
3500	High	Inf. 18.98	6	2313	68	87	661	652	Volt	1463	36	080	
		Type C											
4000	High	110 V. — 500 W. Lamp	7	2235	78	08	483	473	Curr.	1017	93	600	
	Low	32 V. — 75 W. Lamp	7	2235	78	08	413	.....	Curr.	590	85	600	
4500	High	110 V. — 500 W. Lamp	8	2342	87	31	587	565	Curr.	977	100	700	
6000	High	110 V. — 500 W. Lamp	4	3313	54	68	787	769	Curr.	1245	100	1100	
	Low	32 V. — 75 W. Lamp	4	3313	54	68	769	.....	Curr.	785	81	1100	
7500	High	110 V. — 500 W. Lamp	6	3282	73	85	909	889	Volt	1320	60	890	4000
	Low	32 V. — 75 W. Lamp	6	3282	73	85	897	.....	Volt	878	39	890	18100
9050	High	110 V. — 500 W. Lamp	8	2467	87	95	995	972	Volt	946	85	915	
	Low	32 V. — 75 W. Lamp	8	2467	87	95	983	.....	Volt	654	70	915	
12000	High	110 V. — 500 W. Lamp	4	3313	54	68	1099	1074	Volt	567	83	1205	
16000	High	110 V. — 500 W. Lamp	7	2235	78	89	1191	1165	Volt	286	84	1384	
18100	High	110 V. — 500 W. Lamp	8	2467	87	95	1233	1209	Curr.	1352	100	1120	

Figure 35—Table of Typical Dial and Tap Settings

CONTACTOR AND RELAY OPERATING TABLE FOR TRANSMITTER TYPE CAY-52218

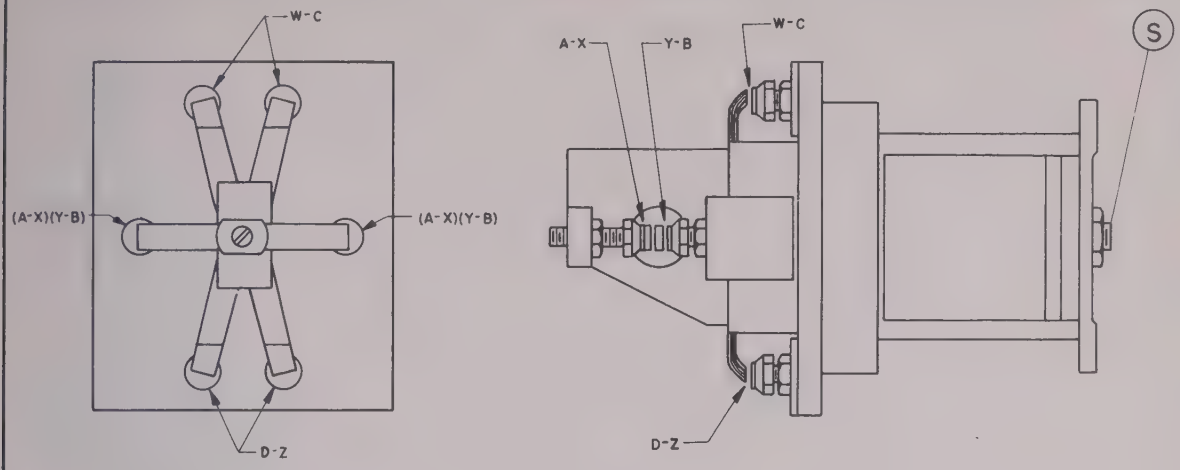
Relay or Contactor Number	Name	Oil Filled	Trip Current	Normal Operation	Remarks
K-1	Keying	No	.....	100 M. A.	
K-2	Compensator	No	.....	10 M. A.	
K-4	Starting	No	.....	*	230 V.D.C.
K-5	H.V. Overload	No	*	.....	Instantaneous
K-7	M.O. Overload	No	*	.....	Instantaneous
K-9	Field	No	.....	*	230 V.D.C.
K-20	Thermostat	No	.....	10 M. A.	230 V.D.C.

Figure 36—Contactor and Relay Operating Table for Transmitter

CONTACTOR AND RELAY OPERATING TABLE FOR MAGNETIC CONTROLLER TYPE CAY-211232

K-851	Contactor	No	.....	*	230 V.D.C.
K-852	Accelerating Contactor				
	Main Coil	No	.....	*	230 V.D.C.
	Holding Coil	No	.....	*	230 V.D.C.
K-853	Accelerating Contactor				
	Main Coil	No	.....	*	230 V.D.C.
	Holding Coil	No	.....	*	230 V.D.C.
K-854	Overload Relay	No	*	.....	230 V.D.C.

Figure 37—Contactor and Relay Operating Table for Magnetic Controller



CAUTION: MAKE ALL ADJUSTMENTS BY RAISING OR LOWERING STATIONARY CONTACT STUDS. DO NOT BEND SPRING CONTACTS. A PIECE OF CROCUS CLOTH SLID BETWEEN SPRING AND STUD WILL CLEAN CONTACTS.

ADJUSTMENT PROCEDURE:

1. PRESS PLUNGER DOWN UNTIL IT BOTTOMS ON STUD. RAISE STUD (S) UNTIL BOTTOM OF INSULATOR IS .375" FROM TOP OF HEX. SHOULDER ON GUIDE PINS. (SEE NOTE BELOW)

2. RAISE PLUNGER .009 INCHES FROM BOTTOM POSITION AND ADJUST CONTACTS (W-C) TO JUST MAKE CONTACT.

3. RAISE PLUNGER AN ADDITIONAL .001 INCHES MAKING A TOTAL OF .010 INCHES FROM BOTTOM AND ADJUST CONTACTS (D-Z), (Y-B), AND (A-X) TO JUST MAKE CONTACT.

4. FINAL ADJUSTMENT IS TO BE MADE BY OBSERVING KEYING WAVE FORM ON OSCILLOGRAPH. THE CONTACTS SHALL CLOSE RELIABLY AND THERE SHALL BE NO CHATTER. REMOVE ANY SLIGHT BREAK BY SLIGHT ADJUSTMENT OF STUD (S). RELAYS WITH PLUNGERS THAT STRIKE BOTTOM ARE CONSIDERED SATISFACTORY, PROVIDED ALL OTHER REQUIREMENTS ARE MET.

   NOTE: ON OLD MODELS WHERE ADJUSTABLE STUDS (S) WERE NOT PROVIDED, STRETCHING SPRINGS (DWG. 7604741, PT.15) IS PERMISSABLE TO REMOVE BOUNCE. WHEN ADJUSTING THESE, OMIT STEP 1.

5. AFTER ADJUSTMENT, CHECK ALL LOCKNUTS AND MAKE CERTAIN THEY ARE TIGHT BEFORE REASSEMBLY OF RELAY IN EQUIPMENT.

KEYING RELAY ADJUSTMENTS

Figure 38—Keying Relay Contact Adjustment for Navy Type CAY-52218 Radio Transmitter Unit (Dwg. P-7711743)

RESTRICTED

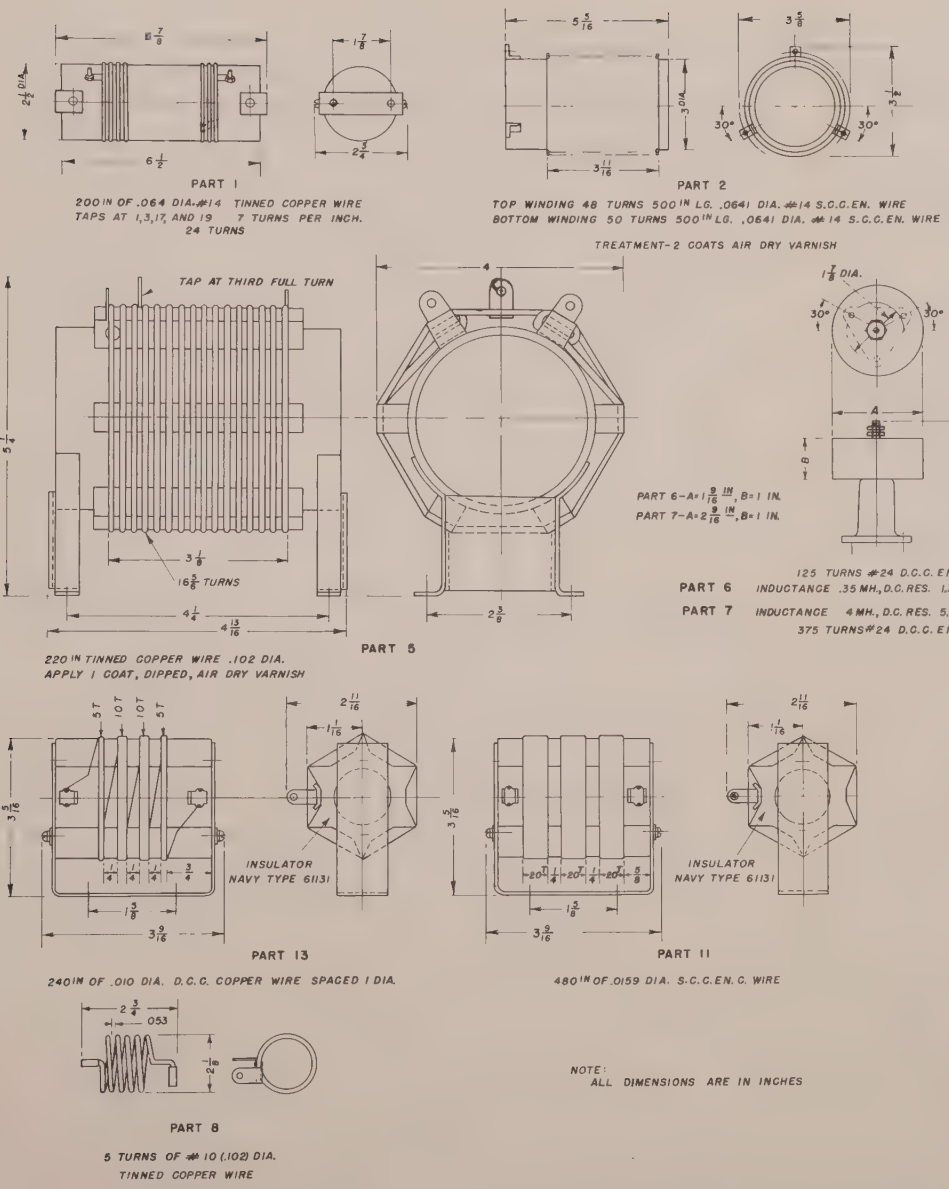
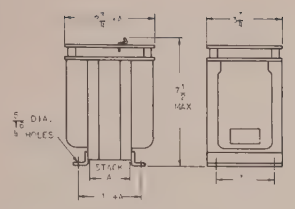

PART 1
200 IN OF .064 DIA. #14 TINNED COPPER WIRE
TAPS AT 1, 3, 17, AND 19 7 TURNS PER INCH.
24 TURNS
PART 2
TOP WINDING 48 TURNS 500 IN LG. .0641 DIA. #14 S.C.C.EN. WIRE
BOTTOM WINDING 50 TURNS 500 IN LG. .0641 DIA. #14 S.C.C.EN. WIRE
TREATMENT-2 COATS AIR DRY VARNISH
INSULATOR
NAVY TYPE 61061
(#10) .190-32 THD.
PART 3
INDUCTANCE 4 MH., D.C. RES. 10 OHMS
PART 4
INDUCTANCE 0.076 MH. MIN.- 0.092 MAX.
65 TURNS #24 D.C.C. E.N.
TAP AT THIRD FULL TURN
16 5/8 TURNS
220 IN TINNED COPPER WIRE .102 DIA.
APPLY 1 COAT, DIPPED, AIR DRY VARNISH
PART 5
PART 6-A=1 9/16 IN, B=1 IN.
PART 7-A=2 9/16 IN, B=1 IN.
PART 6 INDUCTANCE .35 MH., D.C. RES. 1.35 OHMS
125 TURNS #24 D.C.C. E.N.
PART 7 INDUCTANCE 4 MH., D.C. RES. 5.15 OHMS
375 TURNS #24 D.C.C. E.N.
11 3/4 FOR PART 9
10 5/8 FOR PART 10
PART 9 & PART 10
14 TURNS 3/16 X 5/16 COPPER BAR WOUND EDGEWISE
INSULATOR
NAVY TYPE 61131
PART 13
240 IN OF .010 DIA. D.C.C. COPPER WIRE SPACED 1 DIA.
INSULATOR
NAVY TYPE 61131
PART 11
480 IN OF .0159 DIA. S.C.C.EN.C. WIRE
PART 8
5 TURNS OF #10 (.102) DIA.
TINNED COPPER WIRE
NOTE:
ALL DIMENSIONS ARE IN INCHES
PART 12
15 TURNS OF COPPER STRAP 1/2 X 1/16 TK. EDGEWISE WOUND

Figure 39—Dimensional Drawings and Winding Data for Inductances and R. F. Chokes, Transmitter and Modulator Units (Dwg. T-7607966)

RESTRICTED



PART 1 L-317194 A=3 IN.

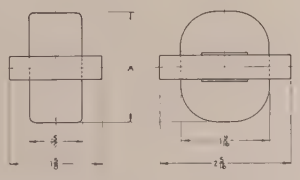
WDG	TAPS	VOLTS	AMPS	TURNS	RESIS. ±15%	WIRE
P 1	1 TO 2	220	0.63	320	8.5 OHMS	#24 S.C.C.E
P 2	3 TO 4	220	0.63	320	10 OHMS	#24 S.C.C.E
S 1	5 TO 6	110	1.1	168	1.3 OHMS	#20 S.C.C.E
S 2	7 TO 8	110	1.1	168	1.7 OHMS	#20 S.C.C.E
TEST 2000 VOLTS						

PART 2 L-317195 A=4 IN.

WDG	TAPS	VOLTS	AMPS	TURNS	RESIS. ±15%	WIRE
P 1	1 TO 2	220	0.8	240	4.0 OHMS	#22 S.C.C.E
P 2	3 TO 4	220	0.8	240	5.6 OHMS	#22 S.C.C.E
S 1	5 TO 6	110	1.5	125	1.65 OHMS	#20 S.C.C.E
S 2	7 TO 8	110	1.5	125	2.0 OHMS	#20 S.C.C.E
TEST 2000 VOLTS						

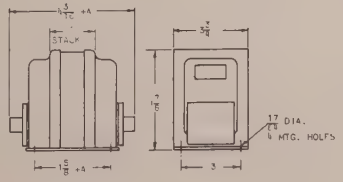
PART 3 L-317196 A = 4 IN.

WDG	TAPS	VOLTS	AMPS	TURNS	RESIS ±15%	WIRE
P 1	4 TO 6	100	1.18	113	1.2 OHMS	#20 S.C.C.E
P 1	5 TO 6	70	1.70	79	1.0 OHMS	#20 S.C.C.E
P 2	1 TO 3	100	1.18	113	1.2 OHMS	#20 S.C.C.E
P 2	1 TO 2	70	1.70	79	1.0 OHMS	#20 S.C.C.E
S 1	7 TO 8	6.7	10.	7	.018 OHM	#12 ENAM.
S 1	7 TO 9	11.4	10	12.5	.032 OHM	#12 ENAM.
S 2	13TO14	5	6.5	6	.005 OHM	#14 ENAM.
S 2	13TO15	10	6.5	12	.05 OHM	#14 ENAM.
S 3	10TO11	5.5	3.25	6.5	.04 OHM	#16 ENAM.
S 3	10TO12	11	3.25	13	.08 OHM	#16 ENAM.
TEST 2500 VOLTS						



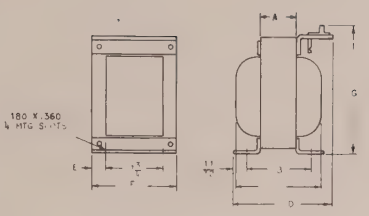
PART 4 L-332701 A=1-9/16

12 WATT, 60 CYCLE
PRIMARY-100V., 0.012 AMP., 4180 TURNS, 675 OHMS.
SECONDARY-0 125V., 10 AMPS., 10 TURNS, 0.009 OHMS.
TEST 1500 VOLTS



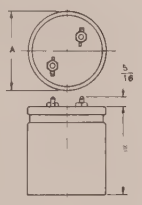
PART 5 L-332702 A = 3/4 IN.

WDG	TAPS	VOLTS	AMPS	TURNS	RESIS. ±15%	WIRE
P 1	1 TO 2	100	0.4	580	16 OHMS	#26 ENAM.
P 2	3 TO 4	100	0.4	580	17 OHMS	#26 ENAM.
SINGLE	5 TO 6	5.5	3.25	34	.045 OHM	#14 ENAM.
SEC	5 TO 7	11	3.25	68	.085 OHM	#14 ENAM.
TEST 1500 VOLTS						



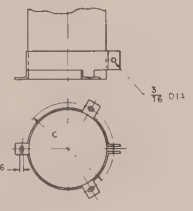
PART 6 L-382513 A = 1 3/16, B=2, C = 2 5/8, D = 3 1/16, E = 3/8, F = 1 1/2, G = 3 9/32

500 TURNS, TAPPED AT 300, 0.18 HENRIES AT 67 V., 60 CYCLES, D.C. RESISTANCE 3.3 OHMS, TEST 1500 VOLTS BETWEEN WINDINGS AND CORE OVER-POTENTIAL, TEST OF 200 V., 800 CYCLES



PART 7 L-365741 A = 2 1/2, B = 3 5/16

WDG	TAPS	VOLTS	AMPS	TURNS	RESIS ±15%	WIRE
PRI	1 TO 2		0.21	1200	1.2 OHMS	#24 S.C.C.E
S 1	3 TO 2		0.0045	3800	1350 OHMS	#42 ENAM.
S 2	2 TO 4		0.0045	3800	2000 OHMS	#42 ENAM.



PART 8 L-365748 A = 2 1/2, B = 3 5/16, C = 3 1/16 DIA.

WDG	TAPS	VOLTS	AMPS	TURNS	RESIS. ±15%	WIRE
PRI	1 TO 2	1.0		400	5.8 OHMS	#26 ENAM.
SEC	3 TO 4	3.2		1280	.62 OHMS	#30 ENAM.
TEST 1200 VOLTS						

PART 9 L-365750 A = 2 1/2, B = 3 5/16, C = 3 1/16 DIA.

WDG	TAPS	VOLTS	AMPS	TURNS	RESIS ±15%	WIRE
P 1	5 TO 6	0.31		250	10 OHMS	#30 ENAM.
	4 TO 6	0.19		150	7 OHMS	#30 ENAM.
S 1	1 TO 2	5.0		3000	1330 OHMS	#40 ENAM.
S 2	2 TO 3	5.0		4000	2000 OHMS	#40 ENAM.
TEST 1500 VOLTS						

PART 10 L-365749 A = 2 1/2, B = 3 5/16, C = 3 1/16 DIA.

WDG	TAPS	VOLTS	AMPS	TURNS	RESIS ±15%	WIRE
P 1	1 TO 2	9		2000	1350 OHMS	#42 ENAM.
P 2	2 TO 3	9		2000	1350 OHMS	#42 ENAM.
S1 & S2	7 TO 8	5.5		1150	105 OHMS	#34 ENAM.
S 3	5 TO 6	14		3000	2500 OHMS	#42 ENAM.
4	4 TO 5	14		3000	2500 OHMS	#42 ENAM.
TEST 1500 VOLTS						

PART 11 L-365779 A = 2 1/2, B = 3 5/16, C = 3 1/16 DIA.

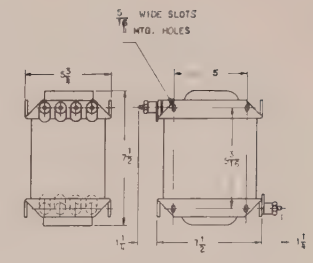
WDG	TAPS	VOLTS	AMPS	TURNS	RESIS ±15%	WIRE
P 1	1 TO 2	5		900	35 OHMS	#30 ENAM.
S 1	3 TO 4	50		9150	5000 OHMS	#40 ENAM.
TEST 1500 VOLTS						

PART 12 L-365751 A = 2, B = 2 13/16, C = 2 9/16 DIA.

4400 TURNS, INDUCTANCE 10 HENRIES AT 3 VOLTS, 60 CYCLES, 0.020 AMP. D.C., RESISTANCE 625 OHMS D.C. ±15%, 60 CYCLE IMPEDANCE 3750 OHMS. TEST 1500 VOLTS, 60 CYCLE

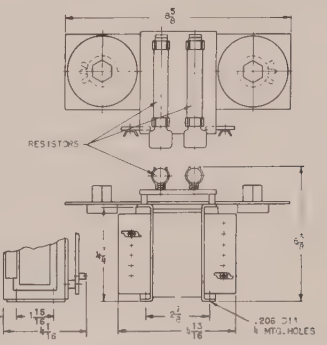
PART 13 L-365752 A = 2, B = 2 3/16, C = 2 9/16 DIA.

2000 TURNS, INDUCTANCE 1.8 HENRIES AT 5.0 VOLTS, 1000 CYCLES, 0 AMP. D.C., RESISTANCE 190 OHMS D.C. ±15%, 60 CYCLE IMPEDANCE 600 OHMS, TEST 1500 VOLTS, 60 CYCLE.



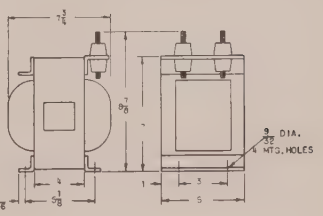
PART 14 L-365742

WDG	TAPS	VOLTS	AMPS	TURNS	RESIS. ±15%	WIRE
P1 & P2	1 TO 2	1150	0.35	800	90 OHMS	#26 S.C.C.E
P2 & P3	3 TO 4	1150	0.35	800	90 OHMS	#26 S.C.C.E
S1 & S2	5 TO 6	243	0.21	171	10 OHMS	#26 S.C.C.E
S1 & S2	6 TO 7	28	0.21	21	1 OHM	#26 S.C.C.E
S1 & S2	7 TO 8	1640	0.21	1218	63 OHMS	#26 S.C.C.E
TEST 8000 VOLTS						



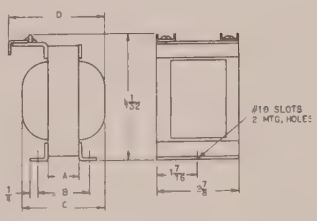
PART 15 L-365744

WDG	TAPS	VOLTS	AMPS	TURNS	RESIS ±15%	WIRE
P 1	1 TO 2	127		750	30.5 OHMS	#29 S.C.C.E
P 2	2 TO 3	127		750	30.5 OHMS	#29 S.C.C.E
S 1	9 TO10	63		375	25.3 OHMS	#29 S.C.C.E
	10TO11	63		375	25.3 OHMS	#29 S.C.C.E
S 2	6 TO 7	38		220	15.0 OHMS	#29 S.C.C.E
	7 TO 8	37		220	14.8 OHMS	#29 S.C.C.E
S 3	4 TO 5	10		60	4.1 OHMS	#29 S.C.C.E
TEST 1500 VOLTS						



PART 16 L-365743

3000 TURNS, INDUCTANCE 35 HENRIES AT 110 VOLTS, 60 CYCLE, 0.27 AMP. D.C., RESISTANCE 105 OHMS D.C. ±15%, 60 CYCLE IMPEDANCE 13200 OHMS, TEST 10,000 VOLTS, 60 CYCLE



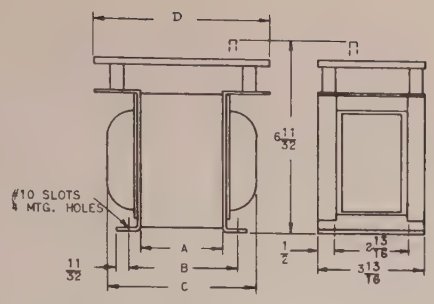
PART 17 L-365747 A = 7/8, B = 1 5/8, C = 2 3/4, D = 3 1/32

210 TURNS, INDUCTANCE 0.067 HENRY AT 4 VOLTS, 60 CYCLE, 0.66 AMP. D.C., RESISTANCE 0.35 OHM D.C. ±15%, 60 CYCLE IMPEDANCE 25 OHMS, TEST 1500 VOLTS, 60 CYCLES

PART 18 L-365753 A=2, B= 2 3/4, C=3 3/4, D=4 3/32

3600 TURNS, INDUCTANCE 30 HENRIES AT 100 VOLTS, 60 CYCLE, 070 AMPS. D.C., RESISTANCE 213 OHMS D.C. ±15%, 60 CYCLE IMPEDANCE 11300 OHMS, TEST 1500 VOLTS, 60 CYCLE.

Figure 40—Dimensional Drawings and Winding Data for Transformers and Reactors, Transmitter and Modulator Units (Dwg. T-7607964)

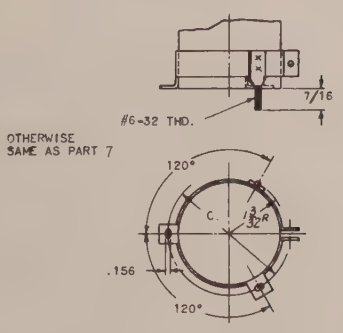


PART 19 L-365745 A=4, B=4-11/16, C=6-1/8, D=7-1/4

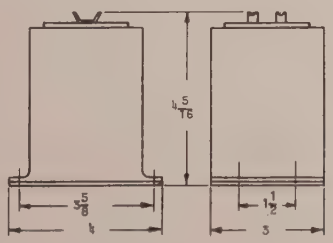
WDG.	TAPS	VOLTS	AMPS.	TURNS	RESIS. ±15%	WIRE
P1	4 TO 5	30	1.0	33	0.6 OHM	#22 S.C.C.E.
	5 TO 6	70	1.0	79	1.4 OHMS	#22 S.C.C.E.
P 2	1 TO 2	70	1.0	78	1.6 OHMS	#22 S.C.C.E.
	2 TO 3	30	1.0	34	0.8 OHM	#22 S.C.C.E.
S 1	7 TO 8	1	1.2	1	0.01 OHM	#18 ENAM.
	8 TO 9	18	1.2	18.5	0.18 OHM	#18 ENAM.
	9 TO 10	2.5	1.2	2.5	0.02 OHM	#18 ENAM.
	10T011	2	1.2	2	0.02 OHM	#18 ENAM.
S 2	13T014	6.5	10	7.5	0.015 OHM	#12 ENAM.
	14T015	4	10	4.5	0.009 OHM	#12 ENAM.
	13T023	5.2	10	6	0.012 OHM	#12 ENAM.
S 3	20T021	1.2	5	1	0.008 OHM	#16 ENAM.
	21T022	1.35	5	2	0.009 OHM	#16 ENAM.
S 4	17T018	3.2	3.3	4.0	0.022 OHM	#18 ENAM.
	18T019	3.2	3.3	3.5	0.026 OHM	#18 ENAM.
S 5	12T016	25	0.3	29	0.55 OHM	#22 S.C.C.E.
TEST 2000 VOLTS						

PART 20 L-365737 A=4, B=4-11/16, C=6-1/8, D=6-15/16

WDG.	TAPS	VOLTS	AMPS.	TURNS	RESIS. ±15%	WIRE
P 1	1 TO 2	220	0.85	240	3.6 OHMS	#22 S.C.C.E.
P 2	3 TO 4	220	0.85	240	6. OHMS	#22 S.C.C.E.
S 1	5 TO 6	110	1.7	125	1.0 OHMS	#20 S.C.C.E.
S 2	7 TO 8	110	1.7	125	1.65 OHMS	#20 S.C.C.E.
TEST 2000 VOLTS						

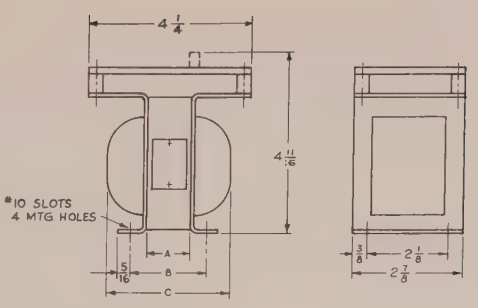


PART 21 L-365754 A=2, B=2-3/16, C=2-9/16 DIA.
500 TURNS, INDUCTANCE 60 MILLIHENRIES AT 3 VOLTS, 60 CYCLE, 0.18 AMP. D.C., RESISTANCE 11 OHMS D.C. ±15%, 60 CYCLE IMPEDANCE 23 OHMS, TEST 1500 VOLTS, 60 CYCLE.



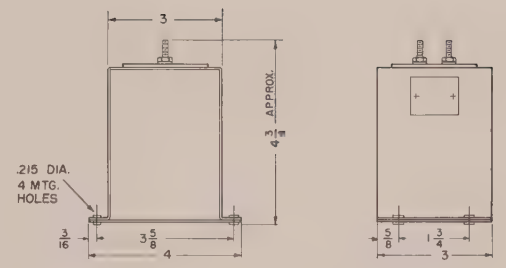
PART 22 L-269718

1600 TURNS, INDUCTANCE AT 110 VOLTS, 60 CYCLE AND 0.5 AMP. D.C., 1 HENRY MIN., D.C. RESISTANCE 40.0 OHMS MAX. 30.0 OHMS MIN., 60 CYCLE IMPEDANCE 377 OHMS MIN., TEST AT 1500 VOLTS A.C.



PART 23 A=1 1/8, B=2, C=3 1/4 L-372133

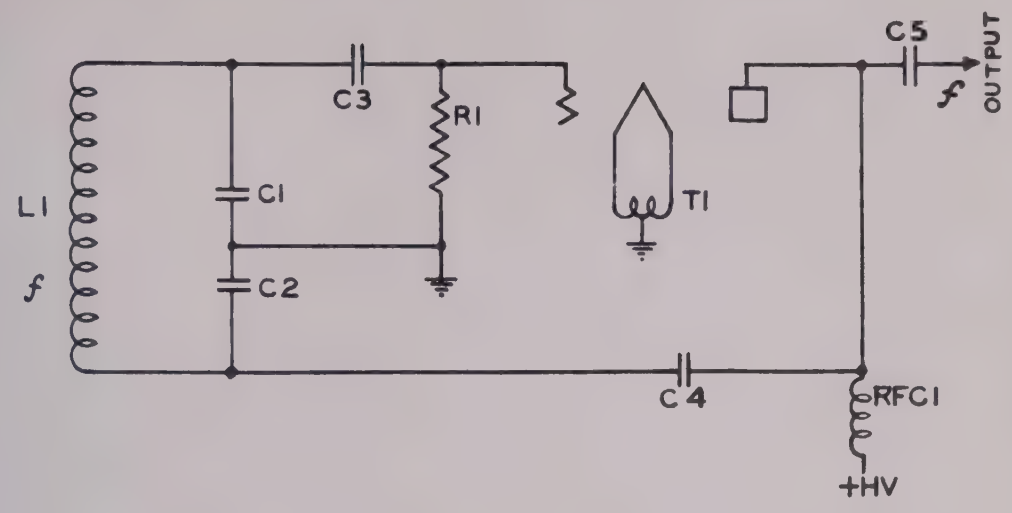
TERMINAL	RESISTANCE	TURNS	VOLTS	AMP.	WIRE SIZE
1-2	20.8 OHMS	560	110	.29	#29 ENAM.
3-4	.06 OHMS	29	5	2.0	#16 ENAM.
5-6	59 OHMS	1170	205	.05	#29 ENAM.
6-7	59 OHMS	1170	205	.05	#29 ENAM.
8-9	.25 OHMS	18	3.1	.9	#22 ENAM.
9-10	.25 OHMS	19	3.2	.9	#22 ENAM.
11-12	8.5 OHMS	141	25	.0006	#29 ENAM.



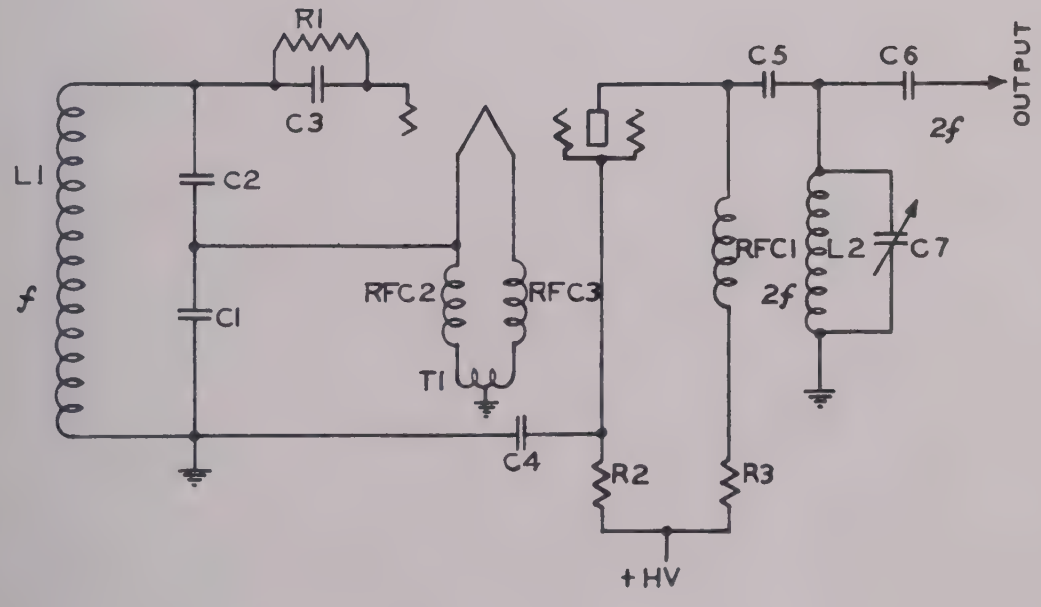
PART 24 L-269718 G-1, 7700950

1600 TURNS; INDUCTANCE 1 HENRY MINIMUM AT 110 VOLTS, 60 CYCLES, 0.5 AMPS. D.C., RESISTANCE 40.0 OHMS MAX., 30 OHMS MIN., TEST 1500 VOLTS, 60 CYCLE; WIRE SIZE - #26 ENAM., TAPS - NONE; WINDING - COMPLETE COIL.

Figure 41—Dimensional Drawings and Winding Data for Transformers and Reactors, Modulator Unit (Dwg. T-7607965)



STANDARD GOLPITTS OSCILLATOR CIRCUIT



ELECTRON COUPLED OSCILLATOR CIRCUIT

Figure 42—Standard Colpitts Electron Coupled Circuit (Dwg. P-7705422)

CAY-T-155 SHEET	NAME OF DRAWING	NAVY TYPE NUMBER	DRAWING NO	TBM-12 230 V. D.C.
1	INDEX TO PLANS FOR RECORD DRAWINGS		T-7614851	
11	WIRING AND ASSEMBLY, H.V. GENERATOR	CAY-21680	33-J-173	X
12	SPECIFICATIONS, H.V. GENERATOR	CAY-21680	33-J-174	X
13	WIRING AND ASSEMBLY, L.V. GENERATOR	CAY-21679	33-J-175	X
14	SPECIFICATIONS, L.V. GENERATOR	CAY-21679	33-J-176	X
29	WIRING AND ASSEMBLY D.C. MOTOR	CAY-21681	33-J-177	X
30	SPECIFICATIONS, D.C. MOTOR	CAY-21681	33-J-178	X
41	OUTLINE, ASSEMBLY AND SPECIFICATIONS, MAGNETIC CONTROLLER	CAY-211232	46-J-406	X

INDEX OF PLANS
FOR
RECORD DRAWINGS
MODEL TBM-12
RADIO TELEGRAPH & TELEPHONE TRANSMITTING EQUIPMENT
CONTRACT NXsr 65327 DATED JUNE 20,1944

SCALE _____ DIMENSIONS IN INCHES _____ DATE _____
WESTINGHOUSE ELECTRIC & MFG. CO. BALTIMORE, MD. U.S.A.

S O WG 15327 D 397977
DRAWN BY C.J.MARIG 2-6-45
CHECKED BY
DESIGN APPROVED
INS. APPROVED C. Stutsman 2-12-45
MECH. ENGINEER P. Hirschmann 2-12-45

APPROVED

APPROVAL LETTER

CONTRACTOR'S FILE NUMBER	BUREAU OF SHIPS FILE NUMBER		
	INDEX	GROUP	FILE NUMBER
T-7614851	CAY	T	155

Figure 43—Index to Plans for Record Drawings (Dwg. T-7614851)

Figure 43—Index to Plans for Record Drawings (Dwg. T-7614851)

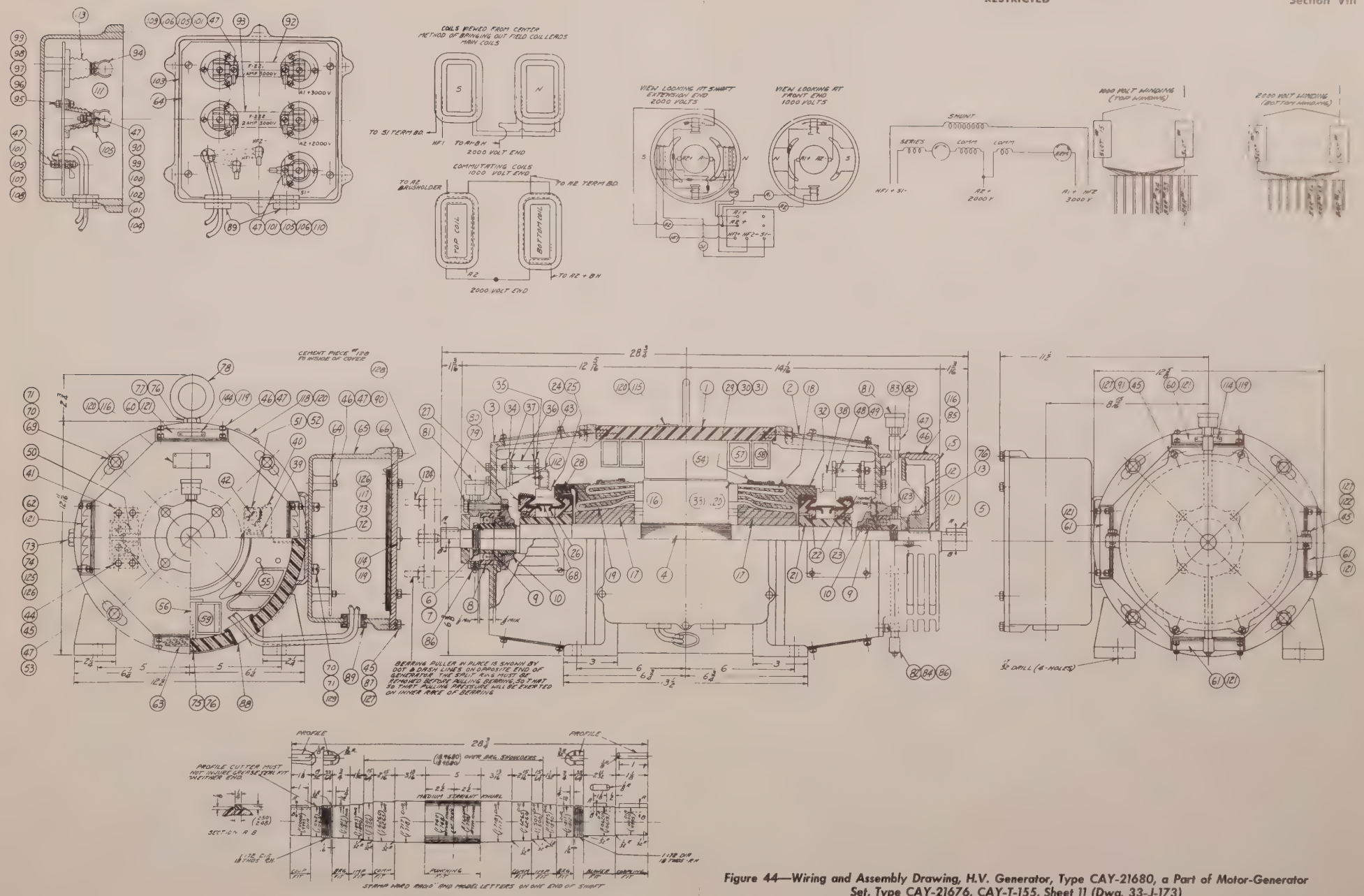

COILS VIEWED FROM CENTER
METHOD OF BRINGING OUT FIELD COIL LEADS
MAIN COILS
TO S1 TERM BD
NF1
TO A1+B1
2000 VOLT END
COMMUTATING COILS
1000 VOLT END
TO A2 TERM BD
TO A2 BRUSHOLDER
TOP COIL
BOTTOM COIL
A2
TO A2 + B1
2000 VOLT END
VIEW LOOKING AT SHAFT EXTENSION END 2000 VOLTS
VIEW LOOKING AT FRONT END 1000 VOLTS
SHUNT
SERIES
COMM
COMM
NF1 + S1-
A2 + 2000 V
A1 + NF2
3000 V
1000 VOLT WINDING (TOP WINDING)
2000 VOLT WINDING (BOTTOM WINDING)
CEMENT PIECE #128 TO INSIDE OF COVER
BEARING PULLER IN PLACE IS SHOWN BY DOT & DASH LINES ON OPPOSITE END OF GENERATOR. THE SPLIT RING MUST BE REMOVED BEFORE PULLING BEARING, SO THAT TO THAT PULLING PRESSURE WILL BE EXERTED ON INNER RING OF BEARING
PROFILE
PROFILE
PROFILE CUTTER MUST NOT INJURE GREASE SEAL FIT ON EITHER END.
SECTION A-B
MEDIUM STRAIGHT KNURL
STAMP SERIAL AND MODEL LETTERS ON ONE END OF SHAFT

Figure 44—Wiring and Assembly Drawing, H.V. Generator, Type CAY-21680, a Part of Motor-Generator Set, Type CAY-21676, CAY-T-155, Sheet 11 (Dwg. 33-J-173)

SPECIFICATIONS FOR D.C. GENERATOR

1. IDENTIFICATION
   (A) SUBMITTED BY - WESTINGHOUSE ELECTRIC & MFG. CO.
   (B) FOR SERVICE - RADIO TRANSMITTING EQUIPMENT
   (C) INSTALLATION - ON BOARD SHIP - TBK T-6-9, TBK 13 & 15
   (D) NUMBER OF GENERATORS - 1 PER EQUIPMENT
   (E) CONTRACT NO's - 80646 (NERS NO-35010) & NO NXS-18287.
   (F) NAVY TYPE - CAY-21680

2. REFERENCE SPECIFICATIONS
   GENERATORS DESCRIBED HEREUNDER WILL CONFORM WITH NAVY DEPARTMENT SPECIFICATIONS 17G1 INT. DATED MAR. 1, 1939 (GENERATORS, DIRECT CURRENT, FOR SHIPBOARD USE)
   AND AS MODIFIED BY CONTRACT NO's 80646 DATED 8 JAN 1941 & SPEC R-1135 ADD A & B

3. REFERENCE DRAWINGS
   THE FOLLOWING PLANS ARE SUBMITTED HEREWITH TO SHOW THE VARIOUS CONSTRUCTION DETAILS WHICH ARE REQUIRED OF "PLANS FOR APPROVAL" AND WHICH CANNOT BE SUITABLY COVERED IN THESE MANUFACTURER'S SPECIFICATIONS.

TITLE OF DRAWING	MANUFACTURER'S NO.	BUREAU NO.
WIRING & ASSEMBLY	33-J-173	
SPECIFICATIONS	33-J-176	

4. GENERATOR RATING
   (A) VOLTS - 2000 FROM ONE COMMUTATOR
   1000 FROM TWO COMMUTATORS IN SERIES
   (B) AMPERES - 0.75 AT 2000 VOLTS
   0.350AT 3000 VOLTS
   (C) K.W. - 2.25
   (D) R.P.M. - 1750 A.C. 60 CYC. DRIVE-1800 D.C. DRIVE-1810A.C.25CYC DRIVE. (GEAR MOTOR)
   (E) TIME RATING - CONTINUOUS
   (F) OVERLOAD RATING - 25% FOR TWO HOURS
   (G) TEMPERATURE RISE - 40° - TABLE 1 METHOD 2

5. GENERATOR CLASSIFICATION
   (A) PRIME MOVER - D.C. MOTOR - A.C. 60CYC. MOTOR-A.C. 25CYC. GEAR MOTOR
   (B) DEGREE OF ENCLOSURE - DRIP PROOF - SEMI-ENCLOSED
   (C) CLASS OF INSULATION - A
   (D) METHOD OF COOLING - SELF VENTILATED
   (E) SERVICE APPLICATION - RADIO TRANSMITTING EQUIPMENT
   (F) AMBIENT TEMPERATURE OF REFERENCE °C. - 50°C.
   (G) TYPE OF WINDING (FIELDS) - COMPOUND WOUND, SEPARATELY EXCITED AT 275 VOLTS D.C.
   (H) MANUFACTURER'S TYPE AND CLASS - X284 SK

6. WEIGHTS
   (A) GENERATOR (COMPLETE) - 310#
   (B) SPARE ARMATURE (COMPLETE) - 75#
   (C) FIELD COIL, SET, COMPOUND (APPROXIMATE) - 22#
   COMMUTATING (APPROXIMATE) - 14#
   (D) SHUNT FIELD RHEOSTAT, SUPPLIED AS PART OF TRANSMITTER
   (E) EXTERNAL COMPENSATOR. - NONE

7. EFFICIENCY
   (A) AT RATED LOAD)
   (B) AT 3/4 LOAD) NO INDIVIDUAL GUARANTEE
   (C) AT 1/2 LOAD)

8. MAGNET FRAME
   (A) MATERIAL - SEE BILL OF MATERIAL
   (B) METHOD OF LEADING IN WIRES - THROUGH FRAME TO PANEL IN TERMINAL BOX
   SIZE OF LEADING-IN WIRES - 19 OF .0147 CABLE R.I.BC.MT CORONA PROOF CABLE PDR2000&3000 VOLT CIRCUITS
   19 OF .0147 R.I.W.P. CABLE FOR 275 VOLT SHUNT FIELD CIRCUIT.

9. MAIN POLES
   (A) NUMBER OF POLES - 8
   (B) AIR GAPS (NOMINAL) - .0625 (SINGLE AIR GAP).

10. COMMUTATING POLES
   (A) NUMBER OF POLES - 2
   (B) AIR GAPS (NOMINAL) - *.0625 (SINGLE AIR GAP.)

11. BEARINGS
   (A) TYPE - BALL
   FRONT BEARING - TYPE G CLASS b GRADE II
   NAVY SPEC. 52-B-5 NO. 306 MF
   NAME OF BEARING MANUFACTURER - MARLIN ROCKWELL CORP.
   REAR BEARING - TYPE G CLASS b - GRADE II
   NAVY SPEC. 52-B-5 NO. 306 MF
   NAME OF BEARING MANUFACTURER - MARLIN ROCKWELL CORP.
   (B) MATERIAL - HARDENED STEEL
   (C) NAVY SYMBOL FOR GREASE - 14-L-3 GRADE A
   (D) BEARINGS SHOWN ARE APPROVED BY BALL BEARING MANUFACTURER AS REQUIRED BY PAR. 7 (c) APPENDIX 1 OF NAVY SPEC. 52-B-5
   MARLIN ROCKWELL CORP. - L.A. CUMMINGS PER ✓

12. SHUNT FIELD WINDING
   (A) WINDING DATA - SHUNT FIELD CONSISTS OF 3350 TURNS OF .0201 ENAMELED ROUND COPPER WIRE WOUND ON A MOULD 5-1/16 IN. LONG BY 3-5/8 IN. WIDE WITH 1/8" RADII AND 1-1/8" THICK.
   (B) INSULATION - SEE NEXT PARAGRAPH
   (C) IMPREGNATION - SEE NEXT PARAGRAPH
   CONNECTIONS BETWEEN COILS CONSIST OF 19 OF .0147 R.I.W.P. CABLE. THE COIL LEADS EXTEND HALF WAY TO THE NEXT COIL + 1 IN.
   SHUNT FIELD LEADS TO EXTERIOR OF FRAME CONSIST OF 19 OF .0147 R.I.W.P. CABLE. EXTERIOR LEADS MUST BE LONG ENOUGH TO REACH THE APPROPRIATE TERMINALS ON THE PANEL.

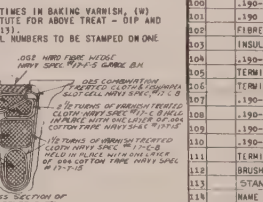
13. SERIES FIELD WINDINGS
   (A) WINDING DATA (2000 VOLT END) - EACH SERIES FIELD CONSISTS OF 357 TURNS OF .1940 S.C.C. ROUND WIRE WOUND ON TOP OF THE SHUNT COIL
   (B) INSULATION - CENTER BLOCK IS WRAPPED WITH 2 LAYERS OF .015 FISHPAPER AND PIECES OF TRINE ARE LAID IN WOULD FOR TYING COIL. FLEXIBLE LEADS ARE ATTACHED TO ENDS OF COIL AND FISH PAPER AND MICA SLIPPED OVER THE LEADS. SHUNT COIL IS WOUND, TIED AND REMOVED FROM MOULD. COIL IS TAPED WITH .007 COTTON TAPE HALF OVERLAPPED. WASHERS OF FOUR THICKNESSES OF .010 TREATED CLOTH PROTECTS SHUNT FROM SERIES COIL. THE FISH PAPER IS REMOVED FROM MOULD AND THE COIL REPLACED. THE SERIES COIL IS WOUND AND LEADS ATTACHED PROTECTED WITH FISH PAPER AND MICA. THE COMPLETE COIL IS TAPED WITH .007 COTTON TAPE HALF OVERLAPPED. PROTECT SHUNT LEADS FROM SERIES COIL AND SERIES LEADS FROM SHUNT COIL SO CREEPAGE DISTANCE ALONG LEADS IS TWO INCHES. PRIOR TO FINAL DIP AND BAKE EXTERNAL LEADS ARE ADDED. LEADS ARE PROTECTED FROM EACH OTHER AND GROUND BY MICA AND VARNISHED CAMBRIC. A CREEPAGE DISTANCE OF 2-1/2 IN. MUST BE MAINTAINED. COIL IS THEN TAPED WITH 2 LAYERS OF .010 VARNISHED CAMBRIC HALF OVERLAPPED. ONCE AROUND UNDER LEADS AND ONCE AROUND OVER LEADS. COIL IS TAPED WITH .007 COTTON TAPE HALF OVERLAPPED.

(C) PERCENTAGE OF MAIN FIELD AMPERE TURNS - (APPROXIMATE) - 22%
(D) IMPREGNATION - COILS ARE SHAPED TO FIT FRAME AND THEN IMPREGNATED BY VACUUM AND PRESSURE IN (W) 579# VARNISH AND THEN TWO TIMES IN BAKING VARNISH (NAVY SPECIFICATION 52-V-13) AFTER PREHEATING 2 HOURS AT 100°C. AFTER EACH DIP COILS ARE BAKED 14 HOURS AT 115°C.
NAVY SUBSTITUTE FOR ABOVE TREATMENTS - DIP AND BAKE 4 TIMES IN (W) VARNISH #335 (NAVY GRADE BB VARNISH 52-V-13).
CONNECTIONS BETWEEN SERIES COILS CONSIST OF 19 OF .0147 R.I.B.C. H.T. CORONA PROOF CABLE. THE LEADS EXT. 2-1/2 IN. FROM THE COIL. THIS CABLE IS ALSO USED FOR CONNECTIONS BETWEEN COILS AND TO TERMINAL BOARD. THE EXTERNAL LEADS MUST BE LONG ENOUGH TO REACH THE APPROPRIATE TERMINALS ON THE PANEL.

14. COMMUTATING FIELD WINDINGS
   (A) WINDING DATA (2000 VOLT) - EACH COMMUTATING COIL CONSISTS OF 1030 TURNS OF .032 EN. RD COPPER WIRE WOUND ON A MOULD 4-13/16 IN. LONG BY 15/16 IN. WIDE WITH 1/8 RADII AND 1-7/16 IN. THK. WINDING DATA (1000 VOLT END) - EACH COMMUTATING COIL CONSISTS OF 515 TURNS OF *.0201 ENAMELED ROUND COPPER WIRE WOUND ON TOP OF 2000 VOLT COIL.
   (B) INSULATION - CENTER BLOCK IS WRAPPED WITH 2 LAYERS OF .015 FISHPAPER AND PIECES OF TWINE ARE LAID IN WOULD FOR TYING COIL. FLEXIBLE LEADS ARE ATTACHED TO ENDS OF COIL AND FISHPAPER AND MICA SLIPPED OVER THE LEADS. 2000 VOLT COIL IS WOUND AND REMOVED FROM WOULD. COIL IS TAPED WITH .007 INCH COTTON TAPE HALF OVERLAPPED. WASHERS OF FOUR THICKNESSES OF .010 TREATED CLOTH PROTECTS 2000 VOLT COIL FROM 1000 VOLT COIL. FISHPAPER IS REMOVED FROM THE WOULD AND THE COIL REPLACED. 1000 VOLT COMM. COIL IS WOUND AND LEADS PROTECTED WITH FISHPAPER AND MICA. THE COIL IS REMOVED FROM THE MOULD AND TAPED WITH ONE LAYER OF .007 COTTON TAPE 1/2 IN. LAPPED. PRIOR TO FINAL DIP AND BAKE EXTERNAL LEADS ARE ADDED. LEADS ARE PROTECTED FROM EACH OTHER AND GROUND BY MICA AND VARNISHED CAMBRIC. A CREEPAGE DISTANCE OF 2-1/2 INCHES MUST BE MAINTAINED. COIL IS THEN TAPED WITH 2 LAYERS OF .010 THICK VARNISHED CAMBRIC HALF OVERLAPPED ONCE AROUND UNDER LEADS AND ONCE AROUND OVER LEADS. COIL IS THEN TAPED WITH .007 INCH COTTON TAPE HALF OVERLAPPED.
   (C) IMPREGNATION - COILS ARE IMPREGNATED BY VACUUM AND PRESSURE IN (W) 579# VARNISH AND THEN TWO TIMES IN BAKING VARNISH (NAVY SPECIFICATION 52-V-13) AFTER PREHEATING 2 HOURS AT 100°C. AFTER EACH DIP COILS ARE BAKED 14 HOURS AT 115°C.
   NAVY SUBSTITUTE FOR ABOVE TREATMENT - DIP AND BAKE 4 TIMES IN (W) VARNISH #335. (NAVY GRADE BB VARNISH 52-V-13).
   CONNECTION BETWEEN COILS CONSIST OF 19 OF .0147 R.I.B.C.H.T. CORONA PROOF CABLE. THE LEADS EXTEND 2-1/2 IN. FROM THE COIL. THIS CABLE IS ALSO USED FOR CONNECTIONS BETWEEN COILS AND TO TERMINAL BOARD. THE EXTERNAL LEADS MUST BE LONG ENOUGH TO REACH THE APPROPRIATE TERMINALS ON THE PANEL.

15. ARMATURE
   (A) DIAMETER - 6-1/2 IN.
   (B) BANDING - *.029 DIA. STEEL WIRE BAND 1-1/2" WIDE EACH END.
   (C) LAMINATIONS SECURED TO SHAFT - BY PRESS FIT ON KNURL.
   WINDING DATA (2000 VOLT)
   ARMATURE CORE HAS 29 SLOTS. COMMUTATOR HAS 145 BARS. WINDING CONSISTS OF 26 TURNS PER COIL OF *.0159 D.S.C. ENAMELED ROUND COPPER WIRE. INSULATED SIZE OF WIRE IS *.0185. WINDING HAS 130 WIRES PER SLOT. FIRST COIL LIES IN SLOTS #1 AND #15. ENDS OF FIRST COIL LIE IN BARS #33 AND #34. WINDING IS TWO CIRCUIT MULTIPLE PROGRESSIVE. COILS ARE WOUND ON A MOULD IN TWO PARTS. PART *A* CONSISTS OF 3 COILS OF 26 TURNS EACH WOUND ON THE MOULD AND TIED. PART *B* CONSISTS OF 2 COILS OF 26 TURNS EACH WOUND ON TOP OF PART *A*. REMOVE COILS FROM THE MOULD AND TAPE PART *B* WITH 1 LAYER .004 COTTON TAPE 1/2 LAPPED. ASSEMBLE PARTS A & B AND INSULATE AS SINGLE COIL. TAPE DIAMONDS WITH 1 LAYER OF 1/2 LAPPED .005 TREATED SILK. ASSEMBLE 1-1/2 TURN .010 THICK WRAPPER ON THE STRAIGHT PART, AND TAPE COIL WITH .005 COTTON TAPE 1/2 LAPPED ON DIAMONDS AND SLIGHTLY SPACED ON THE STRAIGHT PARTS. WIND COILS INTO BOTTOM OF THE SLOTS USING .025 THICK COMBINATION TREATED CLOTH AND FISHPAPER SLOT INSULATION. TAPE TOP AND BOTTOM LAYERS OF COILS ON THE DIAMONDS WITH A PAD CONSISTING OF 3 THICKNESSES OF .010 TREATED CLOTH. PROTECT BETWEEN 2000 AND 1000 VOLT WINDING WITH 3 LAYERS OF .010 TREATED CLOTH.
   WINDING DATA (1000 VOLT)
   ARMATURE CORE HAS 29 SLOTS. COMMUTATOR HAS 145 BARS. WINDING CONSISTS OF 13 TURNS PER COIL OF *.0089 D.S.C. ENAMELED ROUND COPPER WIRE. INSULATED SIZE OF WIRE IS *.0135. WINDING HAS 130 WIRES PER SLOT. FIRST COIL LIES IN SLOTS #1 AND #15. ENDS OF FIRST COIL LIE IN BARS #33 AND #34. WINDING IS TWO CIRCUIT MULTIPLE PROGRESSIVE. COILS ARE WOUND ON A MOULD. TAPE DIAMOND EXTENSIONS WITH 1 LAYER OF 1/2 LAPPED .005 TREATED SILK, ASSEMBLE 2-1/2 TURNS, .010 TREATED CLOTH WRAPPER ON THE SLOT PORTION AND TAPE COIL WITH .005 COTTON TAPE 1/2 LAPPED ON DIAMONDS AND SLIGHTLY SPACED ON THE CORE PORTION. WIND COILS INTO ARMATURE SLOTS ON TOP OF 2000 VOLT WINDING AND USE PAD OF DOUBLE .010 TREATED CLOTH BETWEEN TOP AND BOTTOM COIL SIDES ON THE DIAMONDS. COILS ARE HELD IN THE SLOTS WITH A 1/16 THICK FIBRE WEDGE. PROTECT UNDER THE BANDS WITH 4 LAYERS OF .010 TREATED CLOTH.
   (E) IMPREGNATION - THE COMPLETED WOUND ARMATURE IS TREATED THREE TIMES IN BAKING VARNISH, (W) VARNISH 579# AND BAKED FOR 24 HOURS AT 125°C. NAVY SUBSTITUTE FOR ABOVE TREAT - DIP AND BAKE 3 TIMES IN (W) VARNISH #335 (NAVY GRADE BB VARNISH 52-V-13).
   (F) SHAFT MATERIAL, SEE BILL OF MATERIAL. WORD *RADIO* AND MODEL NUMBERS TO BE STAMPED ON ONE END OF SHAFT.

16. COMMUTATOR
   (A) DIAMETER - 5-1/2 IN.
   (B) LENGTH - 3/8 IN.
   (C) INSULATION BETWEEN BARS - *.032 IN. MICA
   (D) FLUSH OR UNDERCUT-UNDERCUT 1/64 IN.
   (E) INSULATION TO GROUND ON SHAFT-3/32 IN. MICA
   (F) INSULATION TO GROUND ON SHAFT-3/32 IN. MICA



17. BRUSHES
   (A) NO. OF STUDS-4 (2 FOR 2000 VOLT END - 2 FOR 1000 VOLT END.)
   (B) NO. OF BRUSHES PER STUD - 1
   (C) SIZE OF BRUSH - LENGTH 1", WIDTH 1/2" THICKNESS 3/8"
   (D) TRADE NAME OF BRUSH - WORGANITE #G165.
   (E) NAVY SPECIFICATION, SEE BILL OF MATERIAL
   (F) NAME OF BRUSH MANUFACTURER - WORGANITE CARBON CO.

18. SHUNT FIELD RHEOSTAT
   SUPPLIED AS PART OF TRANSMITTER

19. SPARE PARTS

SPARE PARTS LIST BY NAVY TYPE DESIGNATION
FOR MODEL TBW T-8-9 - TBK13-15 TRANSMITTING EQUIPMENT

115V-D.C	230V.D.C	220/3/60	440/3/60	220/3/25	440/3/25	NAME	SYMBOL GROUP
——	——	21668	21669	——	——	MOTOR STARTER A.C.	301 TO 310
21666	21667	——	——	——	——	MOTOR STARTER D.C.	311 TO 330
21669	21670	21680	21690	21690	21691	GENERATOR HIGH VOLTAGE	211 TO 220
21679	21679	21679	21679	21679	21679	GENERATOR LOW VOLTAGE	211 TO 220
——	——	21682	21682	——	——	MOTOR A.C. 3PH. 60CY.	201 TO 210
——	——	——	——	——	——	MOTOR A.C. 3PH. 25 CY.	291 TO 300
——	21681	——	——	——	——	MOTOR D.C. 230 VOLT	251 TO 260
21678	——	——	——	——	——	MOTOR D.C. 115 VOLT	271 TO 290
						TRANSMITTING UNIT	101 TO 199

CONTRACT NO's 80646 DATED 8 JAN. 1941 & NO NXS-18287

SPARE PART BOX				ADDITIONAL CONTROLS 220/3/60 220/3/25	115V D.C.	230V D.C.	NAVY TYPE DESIG.	ALL SYMBOL DESIG. INVOLVED	DESCRIPTION	CONTRACTOR'S DRAWING & PART NUMBER
1	2	3	4						CAY 21680 GENERATOR SPARES	
-	10	-	-	-	X	X	X	F-221	FUSE.1 AMP.5000V. LITTELFUSE #3026	33-J-174 IT.92
-	10	-	-	-	X	X	X	F-222	FUSE,2AMP.5000V. LITTELFUSE #3026	33-J-174 IT.93
-	†2	-	-	-	X	X	X	O-221	BALL BEARING MRC #306 MF	33-J-174 IT.8
-	40	-	-	-	X	X	X	E-221	BRUSHES, WORGANITE #WG165	33-J-174 IT.43
-	2	-	-	-	X	X	X	E-222	SHUNT & SERIES COILS	33-J-174 IT.57,58
-	2	-	-	-	X	X	X	E-223	COMPOUND COIL, COILS	33-J-174 IT.59
-	†2	-	-	-	X	X	X	E-224	BRUSH HOLDER	SP1124399 ■
-	†3	-	-	-	X	X	X	E-224-A	BRUSH HOLDER SPRING	33-J-174 IT.40
-	8	-	-	-	X	X	X	E-225-A	BRUSH HOLDER INSULATOR	33-J-174 IT.36
-	16	-	-	-	X	X	X	E-225-B	FIBRE WASHER	33-J-174 IT.37
-	-	1	-	-	X	X	X	E-228	ARMATURE 2000 VOLTS.75 AMP. 3000 VOLTS.35 AMP.	33-J-174 IT.33
-	10	-	-	-	X	X	X	O-224	BEARING PULLER PARTS	33-J-174 IT.126

†ALSO USED ON GENERATOR ON DWG. 33-J-176 AND TAGGED WITH SYMBOLS OF BOTH APPLICATIONS.
‡ORDERED ON DRIVING MOTOR DWG. AND TAGGED WITH THE SYMBOLS OF ALL APPLICATIONS.
■ANY OF THE FOLLOWING BEARINGS MAY BE USED-MRC 306MF OR SF, NO 7306 OR ND 7606
■ SP1124399 = IT.35-38-39-40-42-50-51-52 OF DWG. 33-J-176.

20. EXCEPTIONS TO NAVY SPECIFICATIONS - THE GENERATORS DESCRIBED HEREIN CONFORM TO THE DETAILED SPECIFICATIONS AS MODIFIED BY SPECIFICATIONS R-1135 ADD. A & B AND CONTRACT NO 80646 IN ALL RESPECTS SAVE THE FOLLOWING - NONE.

LIST OF MATERIAL

QUANTITIES ARE FOR ONE MACHINE

PIECE NO	SYMBOL NO	NAME OF PIECE	NUMBER WANTED	MATERIAL	MATERIAL SPECIFICATION	DRAWING NUMBERS CONTRACTOR	DRAWING NUMBERS BUREAU	STOCK NO
60		TOP, FRONT & REAR COVER	2	SHEET STEEL	47-S-11 CLASS C FIN 3	11-B-839		
61		FRONT SIDES & BOTTOM COVER	1	SHEET STEEL	47-S-11 CLASS C FIN 3	11-B-839		
62		REAR SIDE COVERS	2	SHEET STEEL	47-S-11 CLASS C FIN 3	11-B-839		
63		REAR BOTTOM COVER	1	SHEET STEEL	47-S-11 CLASS C FIN 3	11-B-839		
64		TERMINAL BOARD	1	MICARTA	17-P-5 GRADE XX	78-C-192		
65		TERMINAL BOX	1	M CASTING	46-I-B TYPE A	2-B-9130		
66		TERMINAL BOX COVER	1	M CASTING	46-I-B TYPE A	78-C-193		
67		BRACKET BUSHING	6	BRASS	47-B-2	8-B-8955		
68		FISHPAPER	2	FISHPAPER	17-I-1	8-B-1828		
69		3/8-16X1-1/8HEX.HD.BOLT	8	STEEL	43-B-11 FIN 3			
70		3/8 LOCKWASHER	12	STEEL	NONE			
71		3/8 WASHER	12	STEEL	43-M-1			
72		1/2-13X1-1/4HEX.HD.BOLT	1	STEEL	43-B-11 FIN 3			
73		1/2 LOCKWASHER	2	STEEL	NONE			
74		1/2-13X1-1/2HEX.HD.BOLT	1	STEEL	43-B-11 FIN 3			
75		3/8-16X1-1/2HEX.HD.BOLT	2	STEEL	43-B-11 FIN 3			
76		3/8 LOCKWASHER	6	STEEL	NONE			
77		3/8-16X1-1/2HEX.HD.BOLT	2	STEEL	43-B-11 FIN 3			
78		1/2 EYE BOLT	1	STEEL	46-S-6 CLASS C			
79		5/16-18X2-1/4HEX.HD.BOLT	8	STEEL	43-B-11 FIN 3			
80		5/16 LOCKWASHERS	8	STEEL	NONE			
81		GREASE CUP	2	STEEL	NONE			1250075
82		1/8 PIPE COUPLING	2	STEEL	NONE			1259570
83		1/8X1-1/4 STEEL PIPE	1	STEEL	44-P-10			1259580
84		1/8X2-1/2 STEEL PIPE	1	STEEL	44-P-10			1259590
85		1/8X1/16RD.HD.S.RIVETS	2	COPPER	45-B-11			
86		1/8 PIPE PLUG	2	STEEL	45-C-2			
87		1/4-20X1/8HEX.HD.BOLT	6	STEEL	43-B-11 FIN 3			
88		BUSHING	1	FULLER BRD.	NONE	832135		450457
89		BUSHING	2	RUBBER	NONE			527013
90		.190 WASHER	9	STEEL	43-M-1			779343
91		1/4-20X5/8FIL.HD.I.W.SC	4	STEEL	42-S-5 FIT 3			
92	F221	LITTEL FUSE CAT #3026	1	FUSE	5000V 1 AMP			
93	F222	LITTEL FUSE CAT #3026	1	FUSE	5000V ONE 1.5 AMP AND ONE 2 AMP			
94		FUSE CLIP	4	PHOS.BRONZE	64-C-14	C-6947		585296
95		.138-32X3/4R.HD.I.W.SC	15	STEEL	42-S-5 FIT 3			
96		.138 WASHER	30	STEEL	43-M-1			3408
97		.138 LOCKWASHER	15	STEEL	NONE			
98		.138-32 HEX. NUT	15	STEEL	42-S-5 FIT 3			
99		FIBRE WASHER	20	FIBRE	NONE	1-D-9054		
100		.190-32X5/8RD.HD.I.W.SC	5	STEEL	42-S-5 FIT 3			
101		.190 BRASS WASHER	34	BRASS	43-M-1			779354
102		FIBRE WASHER	5	FIBRE	NONE	1-D-9058		
103		INSULATION STRIP 2-3/8 X 5/8 OF 0.03 TK	1	FISHPAPER	17-I-11	2-B-9131		
104		.190-32 NUT	15	STEEL	42-S-5 FIT 3			
105		TERMINAL	10	CU.TUBE	WW-T-799 TYPE K			229105
106		TERMINAL BLOCK	5	COPPER	47-C-2 TYPE A HARD	C-5114		835963
107		.190-32X1-1/8FIL.HD.B.W.SC	2	BRASS	42-S-5 FIT 3			
108		.190-32 BRASS NUT	6	BRASS	42-S-5 FIT 3			
109		.190-32X3/8FIL.HD.B.W.SC.	4	BRASS	42-S-5 FIT 3			
110		.190-32X5/8FIL.HD.B.W.SC.	1	BRASS	42-S-5 FIT 3			
111		TERMINAL BOX ASSEM.				2-B-9131		
112		BRUSHHOLDER ASSEM.				2-B-2743		
113		STAND OFF INSULATOR	5	CERAMIC	RE-13-A-317	2-B-9131		
114		NAME PLATE #24167 (DANGER)	3	NICKEL SILVER	RE-13-A-516			
115		NAME PLATE #24255 (EYE BOLT)	1	NICKEL SILVER	RE-13-A-516			
116		NAME PLATE #24256 (OPERATION)	2	NICKEL SILVER	RE-13-A-516			
117		5/8-11X1-1/8HEX.HD.BOLT	1	STEEL	43-B-11 FIN 3			
118		NAME PLATE #32503 (RATING)	1	NICKEL SILVER	RE-13-A-516			
119		1/8X1/4 RD.HD. RIVET	8	COPPER CLAD STEEL	45-B-11			
120		ESCUTCHEON PINS #12 X 3/8	12	BRASS PLATED	NONE			
121		BRACKET COVER GASKET	7	CORK COMPOSITION	NONE	5-D 7926		
122		1/4-20X1 HEX.HD.BOLT	4	STEEL	43-B-11 FIN 3			
123		SPACER	1	SEAMLESS STEEL TUBING	44-T-1 SEAMLESS	1-D-9239		
124	D224	BEARING PULLER PARTS	1			97-C-683		
125		5/8-11X1-1/2HEX.HD.BOLT	1	STEEL	43-B-11 FIN 3			
126		5/8 LOCKWASHER	2	STEEL	NONE			
127		1/4 WASHER	12	STEEL	43-M-1			
128		INSULATION	1	FISHPAPER	17-I-11	2-B-9131		
129		5/8-16X 3/4 FIL HD I M SC	4	STEEL	42-S-5 FIT 3			

*EXCEPT ROLLED BAR - 18% ELONGATION IN 2 IN., 30% REDUCTION OF AREA BEND 180° ON 1-1/2 X DIA.

✓APPROVED AS PER CONTRACT.

*THIS MATERIAL IS EQUIVALENT TO OR BETTER THAN THE COMMERCIAL GRADE KNOWN AS SILICON STEEL, ELECTRICAL GRADE.

ΔEXCEPT BRUNNEL 75 UP TO 1/8 THICK.

NAVY SPECS. TO BE OF DATE OF LATEST ISSUE.

⊙TO MEET NAVY SPEC. RE-13-A-317 GRADE F AND ALSO TO HAVE A LOSS FACTOR NOT EXCEEDING 3.5 WHEN MATERIAL IS WET.

□FUSES SHALL BE CAPABLE OF CARRYING INDEFINITELY CURRENTS EQUIVALENT TO 110% OF RATING AND SHALL BLOW WITHIN ONE MINUTE AT 150% RATED CURRENT, STARTING COLD IN AN AMBIENT TEMPERATURE BETWEEN 18 AND 32°C. THEY SHALL BE CAPABLE OF OPENING A CIRCUIT UNDER SHORT CIRCUIT CONDITIONS WITHOUT EMITTING FLAME, MOLTEN METAL OR METALIC VAPORS.

⊕ SURFACE INSPECTION ONLY

⊕ ANY OF THE FOLLOWING BEARINGS MAY BE USED-MRC 306 MF OR SF, NO 7306 OR ND. 7606.

◆ EITHER ISOLANTITE INSULATOR ■356 OR AMER LAVA CORP ■1080 MAYBE FURNISHED

△ ■867128 OR ISOLANTITE INS ■480 MAY BE FURNISHED

LIST OF MATERIAL

QUANTITIES ARE FOR ONE MACHINE

PIECE NO	SYMBOL NO	NAME OF PIECE	NUMBER WANTED	MATERIAL	MATERIAL SPECIFICATION	DRAWING NUMBERS CONTRACTOR	DRAWING NUMBERS BUREAU	STOCK NO
1		FRAME	1	M.R.STEEL	46-S-5 GRADE A			
2		FRONT BRACKET	1	M IRON	46-I-B TYPE A	S A 7672		
3		REAR BRACKET	1	M IRON				
4		SHAFT	1	M.R. STEEL				
5		KEY	2	M.R. STEEL				
6		VOLUTE WASHER	2	SM.STEEL				
7		LOCK NUT	2	M.R.STEEL				
8	0223	BAL. BEARING MRC #306 MF	2					
9		IMPELLER	2					
10		INSIDE BEARING CAP	1					
11		KEY	1	M.R. STEEL				
12		BLOWER	1					
13		3/8-16X1" HEX.HD.BOLT	2	STEEL				
14		3/8-16 HEX. NUT	2	STEEL				
15		COVER	1	ALUMINUM				
16		ROTOR PUNCHINGS	4-5/8	SM.STEEL				
17		COIL SUPPORT	2	SM.PLATE				
18		COIL & FIELD WINDING (ARM)	29					
19		HIGH VOLTAGE COIL (ARM)	29					
20		SLOT WEDGE	29					
21		COMMUTATOR BUSHING	2	M.R.STEEL				
22		COMMUTATOR VEE-RINGS	4	M.R. STEEL				
23		COMMUTATOR NUT	2	M.R. STEEL				
24		COMMUTATOR BAR	290	COPPER				
25		COMMUTATOR BAR (MICA)	290	MICA PLATE				
26		MICA V-RING	4	MICA				
27		INSULATION RING	4	MOLDARTA				
28		INSULATION	2SET		NONE			
29		BANDING WIRE .020 DIA.	29FT	STEEL	NONE			
30		TINNED SHEET STEEL CLIPS	18	TINNED SHEET STEEL	QQ-I-760 TYPE I			
31		INSULATION UNDER BANDS	1SET					
32		TWINE	1SET	FLAX TWINE	NONE			
33	E220	ARMATURE ASSEMBLY	1					
34		BRUSHHOLDER BASE	4	C.R.STEEL	46-S-11 CLASS B			
35	E224	BRUSHHOLDER PLATE	4	SM.BRASS	47-B-2			
36	E225A	BRUSHHOLDER INSULATORS	8	CERAMIC	RE-13-A-317			
37	E225B	INSULATOR WASHERS	16	FIBRE	NONE			
38	E224	BRUSHHOLDER	4	SM.BRASS	47-B-2			
39	E224	B.H. FINGER	4	SM.STEEL	47-S-11 GRADE C			
40		B.H. SPRING	4	SP.STEEL	NONE			
41		B.H. ASSEMBLY CLAMP	8	C.R.STEEL	46-S-17 CLASS B			
42	E226	B.H. PIN	8	C.R.STEEL	46-S-17 CLASS B			
43	E221	BRUSHES	4	MORGANITE NO #165				1133015
44		1/4-20X1-1/4HEX.HD.BOLTS	16	STEEL	43-B-11 FIN 3			
45		1/4 LOCKWASHERS	32	STEEL	NONE			
46		.190-32X1/2FIL.HD.I.W.SC	44	STEEL	42-S-5 FIT 3			
47		.190 LOCKWASHER	62	STEEL	NONE			
48		.190-32X1/2FIL.HD.

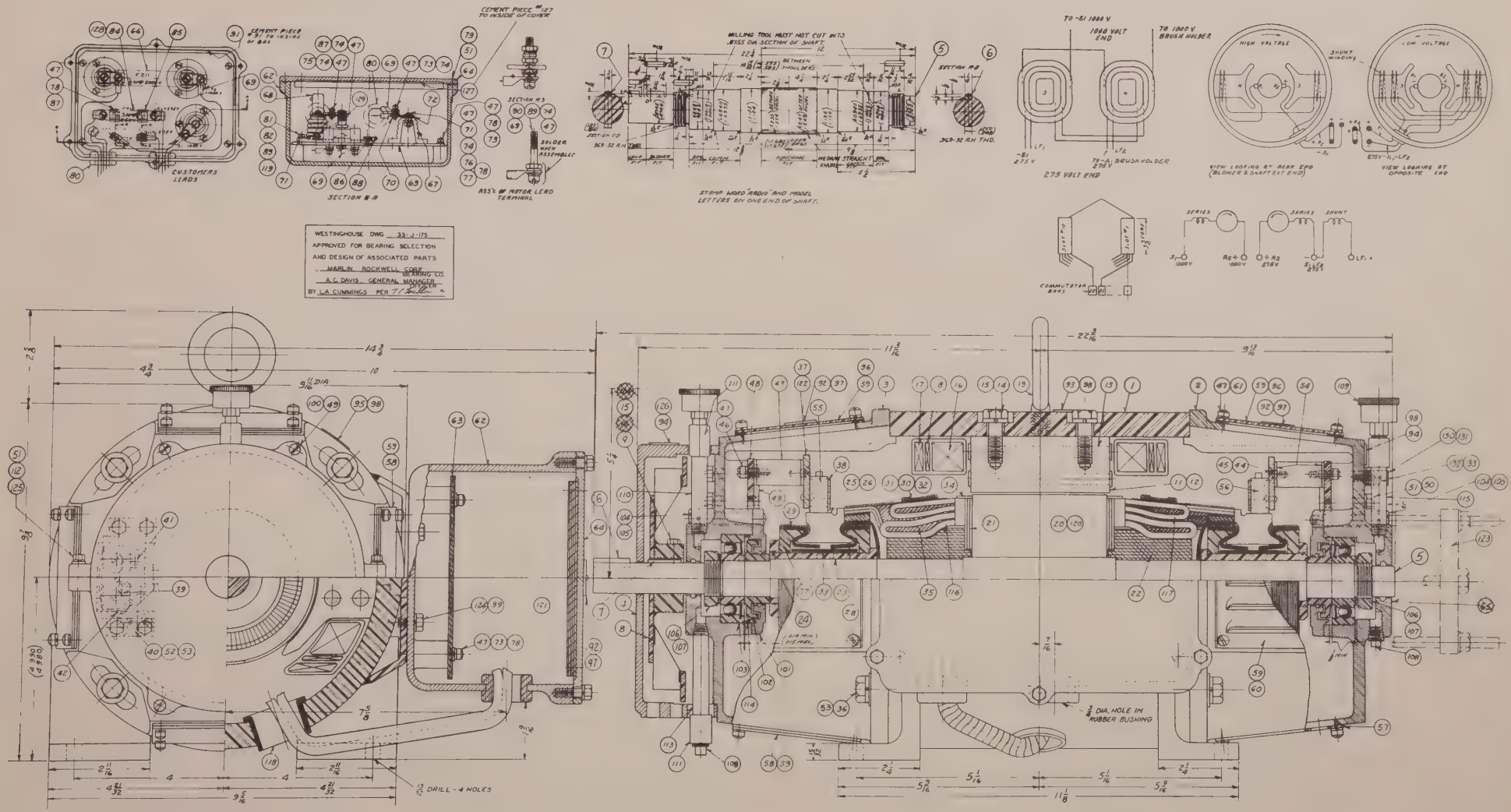

CEMENT PIECE #127 TO INSIDE OF CONN
CEMENT PIECE #91 TO INSIDE OF BOX
CUSTOMERS LEADS
SECTION B-B
SECTION R3
SOLDER WHEN ASSEMBLED
#33½ W MOTOR LEAD TERMINAL
MILLING TOOL MUST NOT CUT INTO .8355 DIA SECTION OF SHAFT
SECTION A-B
369-32 RH THD.
STAMP WORD 'RADIO' AND MODEL LETTERS ON ONE END OF SHAFT.
TO -B1 1000 V
1000 VOLT END
TO 1000 V BRUSH HOLDER
275 VOLT END
HIGH VOLTAGE
SHUNT WINDING
LOW VOLTAGE
VIEW LOOKING AT REAR END (BLOWER & SHAFT EXT END)
VIEW LOOKING AT OPPOSITE END
SERIES
SERIES
SHUNT
COMMUTATOR BARS
WESTINGHOUSE DWG 33-J-175
APPROVED FOR BEARING SELECTION AND DESIGN OF ASSOCIATED PARTS
MARLIN ROCKWELL CORP BEARING CO.
A.G. DAVIS, GENERAL MANAGER
BY L.A. CUMMINGS PER
¾ DIA. HOLE IN RUBBER BUSHING
13/32 DRILL - 4 HOLES

Figure 46—Wiring and Assembly Drawing, L.V. Generator, Type CAY-21679, a Part of Motor-Generator Set, Type CAY-21676, CAY-T-155, Sheet 13 (Dwg. 33-J-175)

SPECIFICATIONS FOR D.C. GENERATORS

1. IDENTIFICATION
   (A) SUBMITTED BY - WESTINGHOUSE ELEC. & MFG. CO.
   (B) FOR SERVICE - RADIO TRANSMITTING EQUIPMENT
   (C) INSTALLATION - ON BOARD SHIP - TBMT-8-9, TBK 13 & 15
   (D) NUMBER OF GENERATORS - 1 PER EQUIPMENT
   (E) CONTRACT - NOa(o)646 (BUSHIPS, WG-35010) & CONT. NO. NKS-18237
   (F) NAVY TYPE - CAY- 21679
2. REFERENCE SPECIFICATIONS
   THE GENERATORS DESCRIBED HEREUNDER WILL CONFORM WITH NAVY DEPARTMENT SPECIFICATION 17G7 INT. DATED MAR. 1, 1939 (GENERATORS, ELECTRIC DIRECT CURRENT, FOR SHIPBOARD AUXILIARIES), AS MODIFIED BY SPECIFICATIONS R-1135 ADD. A & B AND CONTRACT NOa(o)6646 DATED 8 JAN. 1941.
3. REFERENCE DRAWINGS
   THE FOLLOWING PLANS ARE SUBMITTED HEREWITH TO SHOW THE VARIOUS CONSTRUCTION DETAILS WHICH ARE REQUIRED OF "PLANS FOR APPROVAL" AND WHICH CANNOT BE SUITABLY COVERED IN THE MANUFACTURER'S SPECIFICATIONS.

TITLE OF DRAWING	MANUFACTURER'S NO.	BUREAU NO.
WIRING ASSEMBLY	33-J-175	
SPECIFICATIONS	33-J-176	

4. GENERATOR RATING
   (A) VOLTS - 275 FROM ONE COMMUTATOR
   1000 FROM OTHER COMMUTATOR
   (B) AMPERES - 92 AMPERES + EXCITATION OF MAIN GENERATOR AT 275 VOLTS
   .075 AMPERES AT 1000 VOLTS
   (C) WATTS (TOTAL) - 32.8 + EXCITATION ON MAIN GENERATOR
   (D) R.P.M. - 1750 A.C. 60 CYC. DRIVE-1800 DC DRIVE-1810 AC 25 CYC. DRIVE (GEAR MOTOR)
   (E) TIME RATING - CONTINUOUS
   (F) OVERLOAD RATING - 25% FOR TWO HOURS.
   (G) TEMPERATURE RISE 40°C. - TABLE I, METHOD 2
5. GENERATOR CLASSIFICATION
   (A) PRIME MOVER - A. C. 60 CYC. MOTOR-D.C. MOTOR - 25 CYC. AC GEAR MOTOR
   (B) DEGREE OF ENCLOSURE - DRIP-PROOF, SEMI-ENCLOSED.
   (C) CLASS OF INSULATION - A
   (D) METHOD OF COOLING - SELF VENTILATED
   (E) SERVICE APPLICATION - RADIO TRANSMITTING EQUIPMENT
   (F) AMBIENT TEMPERATURE OF REFERENCE - 50°C.
   (G) TYPE OF WINDING (FIELDS) - COMPOUND. SELF EXCITED (275 VOLTS)
   (H) MANUFACTURER'S TYPE AND CLASS - X 204 SK
6. WEIGHTS
   (A) GENERATOR (COMPLETE) - 155#
   (B) SPARE ARMATURE (COMPLETE) - 35#
   (C) FIELD COILS, SET, COMPOUND (APPROXIMATE) - 10#
   (D) SHUNT FIELD RHEOSTAT - SUPPLIED AS PART OF TRANSMITTER
   (E) EXTERNAL COMPENSATOR, NONE
7. EFFICIENCY
   (A) AT RATED LOAD - {
   (B) AT 3/4 LOAD - { NO INDIVIDUAL GUARANTEE
   (C) AT 1/2 LOAD - {
8. MAGNET FRAME
   (A) MATERIAL - SEE LIST OF MATERIAL
   (B) METHOD OF LEADING IN WIRES - THROUGH FRAME AND TERMINAL BOX, SIZE OF LEADING-IN WIRES - 19 OF *.0187 CABLE - LOW VOLTAGE
   19 OF *.0187 H.T.R.I.B.C. CORONA PROOF CABLE - HIGH VOLTAGE
9. MAIN POLES
   (A) NUMBER OF POLES - 2
   (B) AIR GAPS (NOMINAL) - .040 (SINGLE GAP)
10. COMMUTATING POLES
    (A) NUMBER OF POLES - NONE
11. BEARINGS
    (A) TYPE - BALL
    FRONT BEARING - TYPE 6 CLASS D GRADE II
    NAVY SPEC. NO-B-5 NO. 305 W.F.
    NAME OF BEARING MANUFACTURER - MARLIN ROCKWELL CORP.
    REAR BEARING - TYPE 6 CLASS D GRADE II
    NAVY SPEC. NO-B-5 NO. 305 MF
    NAME OF BEARING MANUFACTURER - MARLIN ROCKWELL CORP.
    (B) MATERIAL - HARDENED STEEL
    (C) NAVY SYMBOL FOR LUBRICATING GREASE - 14-L-3 GRADE A
12. SHUNT FIELD WINDING
    (A) WINDING DATA - EACH SHUNT COIL CONSISTS OF 2750 TURNS OF *.0142 ENAMELED ROUND COPPER WIRE, WOUND ON A MOULD 4-3/8 IN. LONG BY 2-1/2 IN. WIDE. WITH 1/8 IN. RADII AND 7/8 IN. THICK.
    (B) INSULATION - SEE NEXT PARAGRAPH
    (C) IMPREGNATION - SEE NEXT PARAGRAPH
    CONNECTIONS BETWEEN COILS CONSIST OF 19 OF *.0147 R.I.W.P. CABLE. THE COIL LEADS EXTEND HALF WAY TO THE NEXT COIL + 1 IN.
    SHUNT FIELD LEADS TO THE EXTERIOR OF THE FRAME CONSIST OF 19 OF *.0147 R.I.W.P. CABLE. EXTERIOR LEADS MUST BE LONG ENOUGH TO REACH THE APPROPRIATE TERMINALS ON THE PANEL.
13. SERIES FIELD WINDINGS
    (A) WINDING DATA - EACH 275 VOLT SERIES FIELD CONSISTS OF 50 TURNS OF *.080 ENAMELED ROUND COPPER WIRE WOUND ON TOP OF THE SHUNT COIL.
    EACH 1000 VOLT SERIES FIELD CONSISTS OF 1300 TURNS OF .0113 ENAMELED ROUND COPPER WIRE WOUND ON TOP OF THE 275 VOLT SERIES COIL.
    (B) INSULATION - BEFORE WINDING, THE CENTER SLOT OF EACH COIL IS WRAPPED WITH 2 LAYERS OF *.015 FISHPAPER AND PIECES OF TWINE ARE LAID IN THE MOULD FOR TYING THE COIL. FLEXIBLE LEADS ARE ATTACHED TO THE ENDS OF THE SHUNT COIL AND FISHPAPER AND MICA SLEEVING PLACED OVER THE LEADS. THE SHUNT COIL IS WOUND, TIED AND REMOVED FROM THE MOULD. THE COIL IS TAPED WITH *.007 COTTON TAPE HALF OVERLAPPED AND WASHERS OF DOUBLE THICKNESS OF .010 TREATED CLOTH PLACED TO PROTECT SHUNT FROM 275 VOLT SERIES COIL. THE FISHPAPER IS REMOVED FROM THE MOULD AND THE COIL REPLACED. THE 275 VOLT SERIES COIL IS WOUND AND LEADS ATTACHED AND PROTECTED WITH FISHPAPER AND MICA. WASHERS OF DOUBLE THICKNESS OF .010 TREATED CLOTH ARE PLACED TO PROTECT SHUNT AND 275 VOLT SERIES COILS FROM 1000 VOLT SERIES COIL WHICH IS THEN WOUND AND LEADS ATTACHED AND PROTECTED WITH FISHPAPER AND MICA. PROTECT SHUNT LEADS FROM SERIES COILS AND SERIES LEADS FROM SHUNT COIL SO CREEPAGE DISTANCE ALONG LEADS IS 1 IN. MINIMUM. PRIOR TO FINAL DIP, THE EXTERNAL LEADS ARE ADDED. THE LEADS ARE PROTECTED FROM EACH OTHER AND COIL BY MICA AND FINISHED IN CAMBRIC. A CREEPAGE DISTANCE OF 1-1/2 IN. MUST BE MAINTAINED. THE COIL IS THEN TAPED WITH 2 LAYERS OF .010 VARNISHED CAMBRIC HALF OVERLAPPED, ONCE AROUND UNDER LEADS AND ONCE AROUND OVER LEADS. COIL IS FINISHED WITH .007 COTTON TAPE HALF OVERLAPPED.
    (C) PERCENTAGE OF MAIN FIELD AMPERE TURNS - 275 VOLT APPROX. 7%
    1000 VOLT APPROX. 6%
    (D) IMPREGNATION - COILS ARE SHAPED TO FIT FRAME AND THEN IMPREGNATED BY VACUUM AND PRESSURE IN (W) #5794 VARNISH AND THEN TREATED TWO TIMES IN BAKING VARNISH NAVY SPECIFICATION 52-V-13 AFTER PRECHEATING 2 HOURS AT 100°C. AFTER EACH DIP COILS ARE BAKED 14 HOURS AT 115°C. CONNECTIONS TO 275 VOLT SERIES COILS CONSIST OF 19 OF *.0187 R.I.W.P. CABLE. CONNECTIONS TO 1000 VOLT SERIES COILS CONSIST OF 19 OF *.0187 H.T.R.I.B.C. CORONA PROOF CABLE. LEADS EXTEND 2-1/2 IN FROM THE COIL. THIS CABLE IS ALSO USED FOR CONNECTIONS BETWEEN COILS AND "T" TERMINAL BOARD. EXTERIOR LEADS MUST BE LONG ENOUGH TO REACH THE APPROPRIATE TERMINALS ON THE PANEL.
    NAVY SUBSTITUTE - DIP AND BAKE 4 TIMES IN (W) VARNISH #335 (NAVY GRADE BB VARNISH 52-V-13).
14. COMMUTATING FIELD WINDINGS - NONE
15. ARMATURE
    (A) DIAMETER - 4-3/8 IN.
    (B) BANDING - .029 DIA. STEEL WIRE 1 IN. WIDE EACH END.
    (C) TAP NATIONS SECURED TO SHAFT BY PRESS FIT ON KNURL.
    (D) WINDING DATA - ARMATURE CORE HAS 20 SLOTS, 2 COMMUTATORS, EACH 100 BARS. BOTTOM WINDING (1000 VOLTS) CONSISTS OF 5 COILS PER SLOT WITH 27 TURNS PER COIL OF .0089 O.S.C. ENAMELED ROUND COPPER WIRE. INSULATED SIZE OF WIRE IS .0135. BOTTOM WINDING HAS 270 STRANDS PER SLOT. TOP WINDING CONSISTS OF 5 COILS PER SLOT, 4 OF 8 TURNS AND 1 OF 7 TURNS PER COIL OF .0179 PAPER COVERED ENAMELLED ROUND COPPER WIRE. INSULATED SIZE OF WIRE IS .0223. TOP WINDING HAS 78 STRANDS PER SLOT. FIRST COILS LIE IN SLOTS #1 AND #10. ENDS OF FIRST COILS LIE IN BARS #21 AND #22. WINDING IS 2 CIRCUIT, MULTIPLE PROGRESSIVE. THE ARMATURE COILS ARE WOUND ON WOULDS. THE END EXTENSIONS OF THE BOTTOM WINDING, CONSISTING OF 5 SINGLE COILS INSULATED AS A UNIT, ARE TAPED WITH A 1/2 LAPPED LAYER OF .005 TREATED SILK TAPE. THE SLOT PORTION IS INSULATED WITH A 1-1/2 TURN .010 THICK TREATED CLOTH WRAPPER. THE COIL IS THEN TAPED WITH .005 COTTON TAPE 1/2 LAPPED ON THE ENDS AND SLIGHTLY SPACED ON THE SLOT PORTION. THE TOP WINDING, CONSISTING OF 5 SINGLE COILS INSULATED AS A UNIT IS TAPED WITH 1 LAYER OF .005 COTTON TAPE 1/2 LAPPED ON THE ENDS AND THE SLOT PORTION. THE COILS ARE WOUND INTO THE CORE USING .025 TK. TREATED CLOTH AND FISHPAPER SLOT CELLS AND HELD IN PLACE WITH 1/16 THICK FIBRE WEDGES. PADS OF 3 THICKNESS OF .010 TREATED CLOTH ARE PLACED BETWEEN THE TOP & BOTTOM LAYERS OF COILS OF EACH WINDING ON THE DIAMONDS AND BETWEEN THE TOP AND BOTTOM WINDINGS ON THE DIAMONDS.
    (E) IMPREGNATION - THE COMPLETE WOUND ARMATURE IS TREATED THREE TIMES IN BAKING VARNISH NAVY SPECIFICATION 52-V-13 AND BAKED FOR 24 HOURS AT 125°C. AFTER E-CH TREATMENT.
    (F) SHAFT MATERIAL SEE LIST OF MATERIAL. WORD "RADIO" & MODEL NUMBERS TO BE STAMPED ON ONE END OF SHAFT.
16. COMMUTATOR
    (A) DIAMETER - 3-3/4
    (B) LENGTH - 7/8
    (C) WEARING DEPTH (REDUCTION IN DIAMETER) - 3/8 IN.
    (D) FLUSH OR UNDERCUT - UNDERCUT 1/64 IN.
    (E) INSULATION BETWEEN BARS - .025 MICA.
    (F) INSULATION TO GROUND ON SHAFT - 3/32 MICA.
17. BRUSHES
    (A) NO. OF SUPPORTS - 4 (2 FOR EACH COMMUTATOR)
    (B) NO. OF BRUSHES PER SUPPORT - 1
    (C) SIZE OF BRUSH - LENGTH - 1, WIDTH 1-3/8, THICKNESS 3/8
    (D) TRADE NAME OF BRUSH - MORGANITE #5165 (1000 VOLT) AND STACKPOLE #L-27 (275 VOLT)
    (E) NAVY GRADE LETTER, SEE LIST OF MATERIAL.
    (F) NAME OF BRUSH MANUFACTURER - MORGANITE CARBON CO. (1000 VOLT)
    STACKPOLE CARBON CO. (275 VOLT)
18. SHUNT FIELD RHEOSTAT
    SUPPLIED AS PART OF TRANSMITTER
19. SPARES

SPARE PARTS LIST BY NAVY TYPE DESIGNATIONS
FOR MODEL TBM 7-8-9 TBK 13 & 15 TRANSMITTING EQUIPMENT

115V-DC	230V-DC	220/3/60	440/3/60	220/3/25	440/3/25	NAME	SYMBOL GROUP
———	———	21686	21689	———	———	MOTOR STARTER A.C.	101 TO 110
2 666	21867	———	———	———	———	MOTOR STARTER D.C.	111 TO 120
2 680	21880	21680	21680	21680	21680	GENERATOR HIGH VOLTAGE	221 TO 240
21679	21879	21679	21679	21679	21679	GENERATOR LOW VOLTAGE	241 TO 260
———	———	21682	21682	———	———	MOTOR AC 3 PH. 60 CYC.	201 TO 210
———	———	———	———	———	———	MOTOR AC 3 PH. 25 CYC.	291 TO 300
———	21881	———	———	———	———	MOTOR DC 230 VOLTS	261 TO 280
21678	———	———	———	———	———	MOTOR D.C. 115 VOLTS	271 TO 290
						TRANSMITTING UNIT	101 TO 199

CONTRACT NOa(o)6646 DATED 8 JAN. 1941, & NO. NKs-18237

SPARE PARTS BOX 1	2	3	4	5	CONTROL CABINETS 115V DC	230V DC	220/3/60	440/3/60	NAVY TYPE DESIG.	ALL SYMBOL DESIG. INVOLVED.	DESCRIPTION	CONTR'S. DWG. & PART NO.
										CAY- 21679	GENERATOR SPARES	
–	10	–	–	–	–	X	X	X	----	F-211	FUSE 1/4 AMP. 5000V LITTELFUSE 3028	33-J-176 PC. 56
–	10	–	–	–	–	X	X	X	----	F-212	FUSE 1 AMP. 2500 V.	33-J-176 PC. 84
–	20	–	–	–	–	X	X	X	----	F-213 & F-214	FUSE RENEWAL LINK 3 AMP. 2500 V.	33-J-176 PC. 128
–	2	–	–	–	–	X	X	X	----	0-213	BALL BEARING WRC #305 MF	33-J-176 PC. 103
–	20	–	–	–	–	X	X	X	----	C-211	BRUSH H.V. WORGANITE #5165	33-J-176 PC. 55
–	20	–	–	–	–	X	X	X	----	C-212	BRUSH L. STACKPOLE ML-27	33-J-176 PC. 56
–	2	–	–	–	–	X	X	X	----	E-213	SHUNT & SERIES COILS	33-J-176 PC. 41, 118
–	*0	–	–	–	–	X	X	X	----	E-214	BRUSH HOLDER	SK 1124399*
–	*0	–	–	–	–	X	X	X	----	E-214-A	BRUSH HOLDER SPRING	33-J-176 PC. 82
–	8	–	–	–	–	X	X	X	----	E-215-A	BRUSHHOLDER INSULATOR	33-J-176 PC. 83
–	16	–	–	–	–	X	X	X	----	E-215-B	FIBRE WASHER	33-J-176 PC. 56
–	–	–	–	–	–	X	X	X	----	E-217	ARMATURE 1000V. .075 AMPS. 275 VOLTS .92 AMPS.	33-J-176 PC. 120
–	20	–	–	–	–	X	X	X	----	0-214	BEARING PULLER PARTS	33-J-176 PC. 123

*ORDERED ON DWG. 33-J-176. PARTS ARE TAGGED WITH SYMBOL OF BOTH APPLICATIONS. ORDERED ON DWG. 33-J-177 PC. 4, A TAGGED WITH SYMBOLS OF ALL APPLICATIONS.
THANKS OF THE FOLLOWING BEARINGS MAY BE USED-MRC 305 MF OR SF, ND 7305 OF ND 7605

CA-124399 = PIECE NOS. 17-38-39-40-41-42-52-53 ON CONTR'S DWG. 33-J-176.

20. EXCEPTIONS TO NAVY SPECIFICATIONS -
    THE GENERATORS DESCRIBED HEREIN CONFORM TO THE DETAILED SPECIFICATIONS AS MODIFIED BY SPECIFICATIONS R-1135 ADD. A & B AND CONTRACT NOa(o)6646 IN ALL RESPECTS SAVE THE FOLLOWING – NONE.

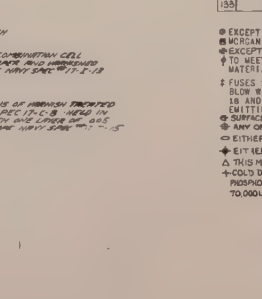
NAVY SPECS. TO BE OF DATE OF LATEST ISSUE.

ALL ALUMINUM SURFACES MUST BE PROTECTED WITH ONE COAT ZINC CHROMATE PRIMER AND TWO COATS OF ALUMINUM PAINT CONSISTING OF ALUMINUM POWDER N.D. SPEC. 52-A-1. 2 POUNDS, AND ALUMINUM SPAR MIXING VARNISH N.D SPEC. 52-V-15, 1 GALLON PER 17G7 PAR. C-5-9 (FIN. #25#).

ALL STEEL BOLTS, NUTS, WASHERS, PINS, SPRINGS AND PLUGS TO BE PROTECTED AGAINST CORROSION AS PER SPEC. R-1135 ADD. A&B PAR. 2-6.

(.190 DIA.) THREADS TO BE NATIONAL FINE SERIES, ALL OTHER THREADS TO BE NATIONAL COARSE THREAD SERIES – UNLESS OTHERWISE SPECIFIED

ALL THREADS TO BE FIT #3 PER 17G7 INT. 3-1-39 PAR. C-10 (b)



LIST OF MATERIAL

QUANTITIES ARE FOR ONE MACHINE

PIECE NO	SYMBOL NO	NAME OF PIECE	NUMBER WANTED	MATERIAL	MATERIAL SPECIFICATION	DRAWING NUMBERS CONTRACTOR	DRAWING NUMBERS BUREAU	STYLE NO.
64		.190-32X1/4FIL.HD.W.SC.	16	STEEL	42-S-5 FIT#3			
65		TERMINAL BOY	1	MI CASTING	46-I-8 TYPE A	2-B-2791		
66		TERMINAL BOARD	1	MICARTA	17-P-5 TYPE PBE	74-C-546		
67		TERMINAL BOX COVER	1	MI CASTING	46-I-8 TYPE A	48-C-430		
68		BRACKET BUSHING	2	BRASS	42-B-2	8-A-2979		
66	E211	LITTEL FUSE CAT #3078 C .2000 VOLT	1	FUSE	R-1135 ADD A PAR 5 (c) 2 & 3 METHOD 2 GRADE C			
67		INSULATOR (STAND OFF)	3	CERAMIC	46-I-8 TYPE A GRADE C			
68		FUSE CLIP	2	PH. BRONZE	46-I-14	L-6947		585296
69		TERMINAL	8	C. TUBING	46-I-7-99 TYPE A			229105
70		TERMINAL BLOCK	3	COPPER	47-C-2 TYPE A HARD	C-5118		835963
71		WASHER	12	FIBRE	33-P-22 GRADE C	1-D-9054		
72		WASHER	3	FIBRE	33-P-22 GRADE C	1-D-9058		
73		.190-32X5/8FIL.HD.W.SC.	5	BRASS	42-S-5 FIT#3			
74		.190 WASHER	14	BRASS	43-B-2			779354
75		.190-32 X 3/8FIL.HD.W.SC.	2	BRASS	42-S-5 FIT#3			
76		.190-32X5/8RD.HD.W.SC.	1	STEEL	42-S-5 FIT#3			
77		.190-32 HEX.W.SC. NUT	1	STEEL	42-S-5 FIT#3			
78		.190 WASHER	7	STEEL	43-B-1			779343
79		1/4-20X3/4 HEX.HD.BOLT	6	STEEL	43-S-11 FIT#3 GRADE BB			
80		BUSHING	2	RUBBER	NONE	876477	527013	
81		.138-32X3/8RD.HD.W.SC	9	STEEL	42-S-5 FIT#3			
82		.138 LOCKWASHER	9	STEEL	NONE			
83		.138-32HEX.W.SC. NUT	9	STEEL	42-S-5 FIT#3			
84	F212	FUSE, 3AMP-250 VOLT	1	FUSE	17-F-2		37155	
85		FUSE CLIP	2	PH. BRONZE	46-B-14	C-6947		585295
86		TERMINAL BLOCK	2	COPPER	47-C-2 TYPE A HARD	C-5118		585519
87		.190-32X3/8RD.HD.W.SC.	4	BRASS	42-S-5 FIT#3			
88		TERMINAL CLIP	2	COPPER	47-C-2 TYPE B SOFT TIN	862570		220336
89		.190-32X1-1/8FIL.HD.W.SC.	4	BRASS	42-S-5 FIT#3			
90		.190-32 HEX. W.SC. NUT	12	BRASS	42-S-5 FIT#3			
91		INSULATION	1	FISKPAPER	IT-I-41	2-B-9100		
92		DANGER NAMEPLATE #24167	3	NI. SILVER	RE-13-A-516			
93		EYEBOLT NAMEPLATE #24255	1	NI. SILVER	RE-13-A-516			
94		LUBRICATION NAMEPLATE #28054	2	NI. SILVER	RE-13-A-516			
95		RATING NAMEPLATE #32503	1	NI. SILVER	RE-13-A-516			
96		SOLID COVER (TOP)	2	SHEET STEEL	47-S-11 GRADE C CLASS 2 FIN. 3	11-B-439		
97		3/8X1/4RD.HD.RIVET	6	NICKEL PLATE	43-B-11 GRADE BB			
98		#12 X 3/8 ESC. PIN	18	NICKEL PLATE	NONE			
99		3/8X1/2 HEX. HD. BOLT	4	STEEL	43-B-11 GRADE BB FIT#3			
100		.190-32 X3/8FIL.HD.W.SC.	4	STEEL	42-S-5 FIT#3			
101		BEARING CAP	2	MI CASTING	46-I-8 TYPE A	7-D-7926		
102		IMPELLER	2	STEEL	46-S-17 CLASS B	7-D-7936		
103	0-213	BALL BEARING WRC #305 MF	2		80-B-5			3196895
104		5/16X1-3/4HEX.HD.BOLT	8	STEEL	43-B-11 GRADE BB			
105		5/16 LOCKWASHER	8	STEEL	NONE			
106		BEARING LOCKWASHER	2	SH. STEEL	47-S-11 GRADE C	836043		372675
107		BEARING LOCKNUT	2	STEEL	46-S-17 CLASS B	836042		372673
108		1/8 PIPE PLUG	2	STEEL	44-F-2			
109		GREASE CUP	2	STEEL	NONE			.035093
110		1/8 PIPE NIPPLE	1	STEEL	44 P-10 GALV.	6-D-6170		1259576
111		1/8 PIPE COUPLING	1	STEEL	NONE	6-D-6170		1259570
112		1/4-20X1 HEX. HD. BOLT	2	STEEL	43-B-11 GRADE BB FIT#3			
113		1/8 PIPE NIPPLE	1	BRASS	44-P-10 GALV	6-D-6171		1259576
114		SPLIT RING	1	STEEL	44-I-1 SEAMLESS	1-D-9239		
115		1/8 PIPE NIPPLE	1	BRASS	44-P-10 GALV	6-D-6170		1259576
116		ARMATURE COIL H.V.	20	DSC EN RD COR WIRE	1.5-B-20.5 C.I.N.	1.372453		
117		ARMATURE COIL L.V.	20	PAPER COVERED RD COR WIRE	1.5-B-2 DSC ENAM.	1.372451		
118		INSULATING TUBE	1	PRESSBOARD	NONE	832135		850457
119		WASHER	18	STEEL	43-B-1			3408
120	E217	ARMATURE ASSY.				2-B-2764		
121		TERMINAL BOX ASSY.				2-B-9100		
122		BRUSHHOLDER ASSY.				2-B-2743		
123	0-214	BEARING PULLER				97-C-683		
124		1/8 LOCKWASHER	4	STEEL	43-B-1			
125		1/8 WASHER	2	STEEL	43-B-1			
126		1/8X 7/16 R.H.RIVET	2	STEEL	43 B-11 MIL#2568			
127		INSULATION	1	FISHPAPER	IT-I-11	2-B-9100		
128		FUSE RENEWAL LINK	3	FUSE	17-F-2			37155
129		FUSE SHOCK SUPPORT	1			6-D-9783		
130		PIPE CLAMP 1/8 PIPE	1	STEEL	NONE			3344
131		CLAMP SPACER	3	STEEL	NONE	9-D-9908		1306971
132		.190 32X3/4FIL HD H SCREW	2	STEEL	42-S-5 FIT#3			
133		.190 LOCK WASHER	2	STEEL	NONE			

LIST OF MATERIAL

QUANTITIES ARE FOR ONE MACHINE

PIECE NO	SYMBOL NO	NAME OF PIECE	NUMBER WANTED	MATERIAL	MATERIAL SPECIFICATION	DRAWING NUMBERS CONTRACTOR	DRAWING NUMBERS BUREAU	STYLE NO.
1		FRAME	1	STEEL	48-S-5 GRADE F		8-A-195	
2		FRONT BRACKET	1	MI. CASTING	46-I-8 TYPE A	9-A-2226		
3		REAR BRACKET	1	MI. CASTING	46-I-8 TYPE A	9-A-2226		
4		BLOWER HOOD	1	MI. CASTING	46-I-8 TYPE A	5-B-7672		
5		SHAFT	1	STEEL			97-C-568	
6		KEY	1	STEEL	86-S-11 CLASS B	92-C-568		
7		KEY	1	STEEL	46-S-17 CLASS B	97-C-568		
8		BLOWER	1	STEEL	47-S-11 CLASS C	78 B178		
9		1/8-18X1"-C.G.HEX.HD.BOLT	2	STEEL	43-B-11 GRADE BB FIT#3	78 B178		
10		1/8-18X1-INCH NUT	2	STEEL	43-B-11 GRADE BB FIT#3	78 B178		
11		POLE ASSEMBLY					1-D-1538	
12		POLE PUNCHING	7-3/4	SM. STEEL	47-S-11 GRADE C FIN. 3	792144		270190
13		5/16 DIA. RIVET	8	STEEL	46-S-17 CLASS B			
14		1/8 X 1 HEX. HD. BOLT	4	STEEL	43-I-11 FIT#3			
15		1/8 LOCKWASHER	14	STEEL	NONE			
16	E213	SHUNT COIL	2	ENAMD WIRE	1.5-A-2 ENAM.	L-372853		
17	E213	H.V. SERIES COIL	2	BK. ROUND WIRE	1.5-A-2 ENAM.	L-372853		
18	E 13	L.V. SERIES COIL	2	D.R. ROUND WIRE	1.5-A-2 ENAM.	L-372853		
19		1/2 EYE BOLT	1	STEEL	46-S-6 NOT CLASS C	813373		
20		ARMATURE PUNCHING	3-3/4	SM. STEEL	Δ		1-D-3536	
21		ARMATURE PUNCHING	6	PRESSBOARD	NONE		55-D-118	270200
22		COIL SUPPORT	2	MOLDARTA	17-P-6 GRADE A	11-B-439	1-D-3546	
23		COMMUTATOR BUSHING	2	STEEL	46-S-5 GRADE A		1-D-3547	
24		COMMUTATOR LOCK NUT	2	STEEL	43-S-2 GRADE A		1-D-3527	
25		COMMUTATOR BAR	100	COPPER	47-C-2 TYPE A HARD		1-D-3549	
26		COMMUTATOR INSULATION	100	MICA	17-M-5 GRADE A		1-D-3549	
27		COMMUTATOR V-RING	2	STEEL	46-S-5 GRADE A		1-D-3548	
28		COMMUTATOR V-RING	4	MICA	17-M-5 GRADE A		1-D-9009	
29		.029 DIA. TWINE	1SET	FLAX	NONE			
30		.029 DIA. BANDING WIRE	100FT	STEEL	NONE			
31		CLIP	18	C. STRAP	47-C-2 TYPE A SOFT			
32		INSULATION	8	TREATED CLOTH	NONE			
33		INSULATING TUBE	2	MICARTA	17-P-5 TYPE PBE	2-A-2768		
34		WEDGE	20	FIBRE	17-F-5 GRADE BH			
35		INSULATION	1SET	TREATED CLOTH	17 C-8			
36		3/8 X 1 HEX. HD. BOLT	8	STEEL	43-B-11 GRADE BB FIT#3			
37	E214	PLATE	4	BRASS	47-B-4 GRADE C	2-B-2783		1124302
38	E214	BRUSHHOLDER	4	BRASS	47-B-4 GRADE C	2-B-2783		1124303
39	E214	FINGER	4	SH. STEEL	47-S-11 GRADE C FIN. 3	28-A-828		1124301
40	E214	PIN	4	STEEL	46-S-17 CLASS B	28-B-828		1124300
41	E214	1/8X5/16RD.HD.RIVET	8	BRASS	NONE			
42	E214	BRUSH HOLDER SPRING	4	SPRING STEEL	NONE			846068
43	E214	INSULATOR (BRUSHHOLDER)	8	CERAMIC	RE-5A-317 GRADE F			
44		.190-32X1/8FLATHD.W.SC.	8	BRASS	42-S-5 FIT#3			
45		LOCKWASHER FOR FLAT HD.SC	8	STEEL	NONE		57-D-623	
46		.190-32X1/2FIL.HD.W.SC.	8	STEEL	42-S-5 FIT#3			2021562
47		.190 LOCKWASHER	48	STEEL	NONE			
48		BRUSHHOLDER BASE	4	STEEL	46-S-17 CLASS B	2-B-2743		
49		CLAMP	8	STEEL	46-S-17 CLASS B	2-B-2743		
50		1/8-20X1-1/8HEX.HD.BOLT	16	STEEL	43-B-11 FIT#3			
51		1/8 LOCKWASHER	20	STEEL	NONE			
52	E214	4/16X1/2 SPRING COTTER PIN	4	STEEL	42-P-7			
53	E214	3/8 WASHER	12	STEEL	43-B-1			
54		WASHER	16	FIBRE	33-P-22 GRADE C		1 D 9054	
55	E211	BRUSH (HIGH VOLTAGE)	2	MORGANITE #5165	■			1133015
56	E212	BRUSH (LOW VOLTAGE)	2	STACKPOLE ML 27	17-B-8			1133016
57		PERFORATED COVER	1	SHEET STEEL	47-S-11 CLASS C FIN. 3	11-B-439		
58		SOLID COVER	3	SHEET STEEL	47-S-11 CLASS C FIN. 3	11-B-439		
59		GASKET	7	"NOPACO" CORK	NONE	5-D-7928		
60		LOUVRE COVER	2	SHEET STEEL	47-S-11 CLASS C FIN. 3	11-B-439		

● EXCEPT ROLLED BAR 18% ELONGATION IN 2 IN., 30% REDUCTION OF AREA, BENDS 180° ON 1-1/2 X DIA.
■ MORGANITE MM-6165 APPROVED AS PER CONTRACT.
◆ EXCEP

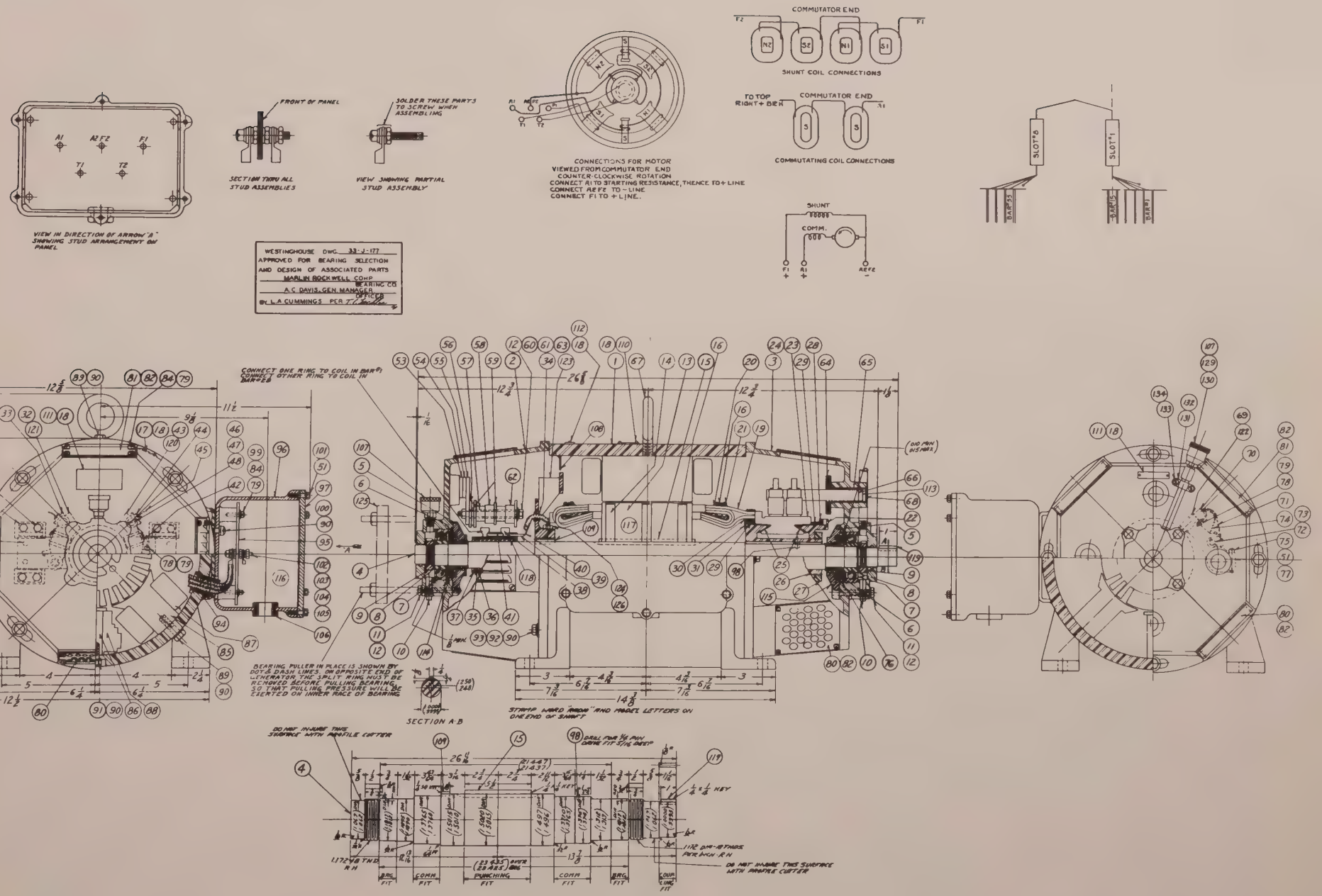

A1 A2 F2 F1 T1 T2
VIEW IN DIRECTION OF ARROW "A" SHOWING STUD ARRANGEMENT ON PANEL
FRONT OF PANEL
SECTION THRU ALL STUD ASSEMBLIES
SOLDER THESE PARTS TO SCREW WHEN ASSEMBLING
VIEW SHOWING PARTIAL STUD ASSEMBLY
CONNECTIONS FOR MOTOR VIEWED FROM COMMUTATOR END COUNTER-CLOCKWISE ROTATION
CONNECT A1 TO STARTING RESISTANCE, THENCE TO + LINE
CONNECT A2 F2 TO - LINE
CONNECT F1 TO + LINE.
COMMUTATOR END
F2
F1
N2
S2
N1
S1
SHUNT COIL CONNECTIONS
TO TOP RIGHT + BR
COMMUTATOR END
A1
S
S
COMMUTATING COIL CONNECTIONS
SHUNT
COMM.
F1 +
A1 +
A2 F2 -
SLOT #6
SLOT #1
DAMPER
DAMPER
WESTINGHOUSE DWG. 33-J-177
APPROVED FOR BEARING SELECTION AND DESIGN OF ASSOCIATED PARTS
MARLIN ROCKWELL CORP.
BEARING CO
A.C. DAVIS, GEN. MANAGER
OFFICE
BY L.A. CUMMINGS PER
CONNECT ONE RING TO COIL IN BAR #1
CONNECT OTHER RING TO COIL IN BAR #28
BEARING PULLER IN PLACE IS SHOWN BY DOT & DASH LINES ON OPPOSITE END OF ARMATURE THE SPLIT RING MUST BE REMOVED BEFORE PULLING BEARING SO THAT PULLING PRESSURE WILL BE EXERTED ON INNER RACE OF BEARING
SECTION A-B
STAMP WORD "FRONT" AND MAKE LETTERS ON ONE END OF SHAFT
DO NOT IN-JURE THIS SURFACE WITH PROFILE CUTTER
DRILL FOR 5/8 PIN CAN BE FIT 5/16 DEEP
1/4 x 1/8 KEY
1.172 V8 THD. R.H.
.1112 DIA. BETWEEN PER INCH R.H.
DO NOT IN-JURE THIS SURFACE WITH PROFILE CUTTER
BRG. FIT
COMM. FIT
PUNCHING FIT
COMM. FIT
BRG. FIT
COUPLING FIT

Figure 48—Wiring and Assembly Drawing, D.C. Motor, Type CAY-21681, a Part of Motor-Generator Set, Type CAY-21676, CAY-T-155, Sheet 29 (Dwg. 33-J-177)

SPECIFICATIONS FOR DC MOTORS

1. IDENTIFICATION
   (A) SUBMITTED BY - WESTINGHOUSE ELECTRIC & MFG. CO.
   (B) FOR SERVICE - RADIO TRANSMITTING EQUIPMENT
   (C) INSTALLATION - ON BOARD SHIP - TBW-7 & TBK-13
   (D) NO. OF MOTORS - 1 PER EQUIPMENT
   (E) CONTRACT - NOs. 80646 (WEARS WG 35010) & NO NKS-18237
   (F) NAVY TYPE CAY 21681

2. REFERENCE SPECIFICATIONS
   THE MOTORS DESCRIBED HEREUNDER WILL CONFORM WITH NAVY DEPARTMENT SPECIFICATIONS 17-M-96 (MOTORS & CONTROLLERS-DIRECT CURRENT-FOR SHIPBOARD AUXILIARIES), AS MODIFIED BY SPECIFICATIONS R-1135 ADDENDA A & B & CONTRACT NO80646, DATED 8 JAN 1941

3. REFERENCE DRAWINGS
   THE FOLLOWING PLANS ARE SUBMITTED HEREWITH TO SHOW THE VARIOUS CONSTRUCTION DETAILS WHICH ARE REQUIRED OF "PLANS FOR APPROVAL" AND WHICH CANNOT BE SUITABLY COVERED IN THOSE MANUFACTURER'S SPECIFICATIONS.

TITLE OF DRAWING	MANUFACTURER'S NO.	BUREAU NO.
WIRING & ASSEMBLY	33-J-177	
SPECIFICATIONS	33-J-178	

4. MOTOR RATING
   (A) VOLTS - 230
   (B) AMPERES - 22
   (C) HORSEPOWER - 5
   (D) R.P.M. - 1800
   (E) DUTY - CONTINUOUS
   (F) METHOD OF TEMPERATURE MEASUREMENT - TABLE 1 METHOD 2
   (G) A.C. WATTS FROM COLLECTOR RINGS - 535
   (H) A.C. VOLTS - 162
   (I) CYCLES - 60

5. MOTOR CLASSIFICATIONS
   (A) DEGREE OF ENCLOSURE - DRIP PROOF - SEMI-ENCLOSED
   (B) METHOD OF COOLING - SELF VENTILATED
   (C) SPEED - CONSTANT
   (D) TYPE OF WINDING (FIELDS) - SHUNT
   (E) AMBIENT TEMPERATURE OF REFERENCE, °C. - 50°.
   (F) MANUFACTURER'S TYPE & CLASS - X259 SK

6. WEIGHTS
   (A) MOTOR (COMPLETE) - 275#
   (B) SPARE ARMATURE (COMPLETE) - 70#
   (C) FIELD COILS, SET, SHUNT (APPROXIMATE) - 20#
   INTERPOLE (APPROXIMATE) - 10#

7. EFFICIENCY
   (A) AT RATED LOAD - (
   (B) AT 3/4 LOAD - (NO INDIVIDUAL GUARANTEE
   (C) AT 1/2 LOAD - (

8. MAGNET FRAME
   (A) MATERIAL - SEE BILL OF MATERIAL
   (B) SOLID OR SPLIT - SOLID
   (C) METHOD OF LEADING IN WIRES - THROUGH FRAME TO TERMINAL BOX
   (D) SIZE OF LEADING-IN WIRES - 19 OF *0226 CABLE FOR ARMATURE & INT. POLES - 19 OF *.0147 CABLE FOR SHUNT FIELD
   (E) LEADS SECURED TO TERMINAL BOARD.

9. MAIN POLES
   (A) NUMBER OF POLES - 4
   (B) AIR GAPS (NOMINAL) - *.0625 SINGLE AIR GAP

10. END BRACKETS
    (A) MATERIAL - SEE BILL OF MATERIAL
    (B) COVERS - DRIP PROOF - SEMI-ENCLOSED.

11. SHAFT MATERIAL
    SEE BILL OF MATERIAL. WORD "RADIO AND MODEL LETTERS TO BE STAMPED ON ONE END OF SHAFT.

12. COMMUTATING POLES
    (A) NUMBER OF POLES - 2
    (B) AIR GAPS (NOMINAL) - *.047 SINGLE AIR GAP

13. BEARINGS
    (a) TYPE - BALL
    FRONT BEARING - TYPE C CLASS b GRADE II
    NAVY SPEC. - 42 B5 NO. 306 WF
    NAME OF BEARING MANUFACTURER - MARLIN ROCKWELL CORP.
    REAR BEARING - TYPE C CLASS b GRADE II
    NAVY SPEC. 42 B5 NO. L-306
    NAME OF BEARING MANUFACTURER - MARLIN ROCKWELL CORP.
    (B) MATERIAL - HARDENED STEEL
    (C) NAVY SYMBOL FOR GREASE - 14-L-3 GRADE A

14. SHUNT FIELD WINDINGS
    EACH SHUNT COIL CONSISTS OF 2600 TURNS OF .0201 DIAM. ENAMELLED ROUND COPPER WIRE. THE COIL IS WOUND IN A SHELL CONSISTING OF A 3/16" THICK MICARTA TUBE WITH 1/8" THICK FULLERBOARD END WASHERS. L-SHAPED PIECES OF .015 FISHPAPER ARE PLACED ALONG SIDES OF COIL TO PROTECT FROM FRAME AND POLE TIPS. IT IS TAPED OVERALL WITH A HALF-LAPPED LAYER OF .007 COTTON TAPE, THEN IMPREGNATED BY VACUUM & PRESSURE METHOD (W)5798 VARNISH. IT IS THEN TREATED ONCE WITH SHELLAC AND GIVEN TWO DIPPING AND BAKING TREATMENTS WITH (W) VARNISH #311. THE COIL ENDS, MADE FROM 41 STRANDS OF .010 BRAID COVERED CABLE #7414-L, LEADS EXTEND HALF WAY TO THE NEXT COIL PLUS ONE INCH. THE CENTER BLOCK OR MOULD IS 1-11/16 WIDE, 5-1/4 LONG WITH 1/8" RADII AT CORNERS.
    SHUNT LEADS TO EXTERIOR OF FRAME CONSIST OF 19 OF .0147 R.I.W.P. CABLE.
    NAVY SUBSTITUTE FOR ABOVE TREATMENT - DIP &BAKE 4 TIMES IN (W) VARNISH #335 (NAVY GRADE BB VARNISH 52-V-13).

15. SERIES FIELD WINDINGS - NONE

16. COMMUTATING FIELD WINDING
    EACH COMMUTATING COIL CONSISTS OF 57 TURNS OF .129 D.C.C.-SQ. COPPER WIRE WOUND IN A SHELL MADE UP OF 1/16" THICK MICARTA CENTER TUBE AND 1/8" THICK FULLERBOARD END WASHERS. THE WOULD IS 11/16 WIDE, 4-7/8 LONG, WITH 1/4" RADII AT CORNERS. THE COIL IS IMPREGNATED BY VACUUM-PRESSURE METHOD WITH (W) #543 GUM. IT IS THEN TREATED ONCE WITH SHELLAC AND GIVEN TWO DIPPING AND BAKING TREATMENTS WITH (W) VARNISH #311.
    NAVY SUBSTITUTE FOR GUM TREATED COILS - DIP AND BAKE 4 TIMES IN (W) VARNISH #335 (NAVY GRADE BB VARNISH 52-V-13).
    CONNECTIONS BETWEEN COMMUTATING COILS CONSIST OF 19 OF *.0226 R.I.W.P. CABLE. LEADS TO TERMINAL BOARD CONSIST OF 19 OF .0226 R.I.W.P. CABLE.

17. ARMATURE
    (A) DIAMETER - 5-3/4 IN.
    (B) BANDING - .029 DIA. STEEL 7/8 IN. WIDE ON COIL ENDS & 3-1/2 IN. WIDE BANDS TO HOLD COILS IN SLOTS.
    (C) LAMINATIONS RIVETED TOGETHER BETWEEN END PLATES AND SECURED TO SHAFT BY A STEEL KEY AND PRESS FIT.
    (D) WINDING DATA-
    ARMATURE CORE HAS 27 SLOTS. THE FINISHED SIZE OF SLOT IS .255 WIDE BY .880 DEEP. THE COMMUTATOR HAS 107 BARS. COIL HAS 3 TURNS. IT IS WOUND IN WIDE-BY-5 DEEP FROM 4 STRANDS OF .032 X .102 D.C.C. COPPER RIBBON. THE COIL IS PULLED TO SHAPE, TAPED, THEN DIPPED AND BAKED WITH (W) VARNISH #327 (NAVY GRADE BB VARNISH 52-V-13). THE SLOT PORTION OF THE COIL IS WRAPPED WITH 1-1/2 TURNS OF .012 THICK FISHPAPER AND MICA, TAPED WITH A LAYER OF .005 COTTON TAPE WHICH IS HALF-OVERLAPPED ON ENDS AND SLIGHTLY SPACED ON SLOT PORTION, THEN DIPPED AND BAKED IN (W) VARNISH #327 (NAVY GRADE BB VARNISH 52-V-13). A .010 THICK PARAFFINED FISHPAPER SLOT LINER IS USED WHEN WINDING COILS IN CORE.
    THE FIRST COIL LIES IN SLOT #1 AND #8 AND IS CONNECTED TO COMMUTATOR BARS #1 AND #55. THE WINDING IS WAVE PROGRESSIVE WITH A DEAD COIL. THE WOUND ARMATURE IS GIVEN THREE DIPPING AND BAKING TREATMENTS WITH (W) VARNISH #7559-1 (NO NAVY EQUIVALENT). CROSS SECTION OF SLOT SHOWS METHOD OF INSULATION.
    NAVY SUBSTITUTE FOR ABOVE TREATMENT - DIP AND BAKE 3 TIMES IN (W) VARNISH #335 (NAVY GRADE BB VARNISH 52-V-13).

18. COMMUTATOR
    (A) DIAMETER - 4-1/2
    (B) LENGTH - 2-3/4
    (C) WEARING DEPTH (REDUCTION IN DIAMETER) - 1/2 IN.
    (D) FLUSH OR UNDERCUT - UNDERCUT 1/32 IN.
    (E) INSULATION BETWEEN BARS - *.025 MICA.
    (F) INSULATION TO GROUND ON SHAFT - 1/16 IN. MICA.

19. D.C. BRUSHES
    (A) NO. OF BRUSH HOLDER RODS - 4
    (B) NO. OF BRUSHES PER BRUSH HOLDER - 1 (2 HOLDERS PER ROD)
    (C) SIZE OF BRUSH -
    LENGTH - 1-1/2 WIDTH - 3/4, THICKNESS - 3/8
    (D) TRADE NAME OF BRUSH - STACKPOLE-27
    (E) NAVY GRADE LETTER (17-B-8) - GRADE B
    (F) NAME OF BRUSH MANUFACTURER - STACKPOLE CARBON CO.

20. COLLECTOR
    (A) NO. RINGS - 2
    (B) DIAMETER - 3 IN.
    (C) WEARING DEPTH (REDUCTION IN DIAMETER) - 3/8 IN.
    (D) INSULATION - MICA
    (E) INSULATION TO GROUND ON SHAFT - 1/32 IN.
    (F) CONNECT ONE RING TO COIL IN BAR 1, CONNECT OTHER RING TO COIL IN BAR 28

21. A.C. BRUSHES
    (A) NUMBER OF BRUSH HOLDERS - 4- (2 PER RING.)
    (B) BRUSHES PER BRUSH HOLDER - 1
    (C) SIZE OF BRUSH -
    LENGTH - 7/8, WIDTH - 1/2, THICKNESS - 1/4
    (D) TRADE NAME OF BRUSH - STACKPOLE-27
    (E) NAVY GRADE LETTER (17B8) - GRADE B
    (F) NAME OF BRUSH MANUFACTURER - STACKPOLE CARBON CO.

22. SPARE PARTS

SPARE PARTS LIST BY NAVY TYPE DESIGNATIONS
FOR MODEL TBH 7-9 TBH STRANSMITTING EQUIPMENT

115V-DC	230V-DC	220/3/50	440/3/60	220/1/25	440/1/25	NAME	SYMBOL	GROUP
		21680	2 669			MOTOR STARTER A.C.	301	TC 110
2 666	21667	—	—	—	—	MOTOR STARTER D.C.	311	TC 110
21680	21680	21680	21680	21680	2 680	GEN. FIELD VC T.C.	201	TC 150
21679	2 679	21679	21679	21679	21679	GEN. LOW VOLTAGE	211	TC 220
—	—	21682	2 682	—	—	MOTOR A.C. 3PH. 60 CYC.	291	TC 200
—	—	—	—	—	—	MOTOR A.C. 3PH. 25 CYC.	281	TC 100
—	2 668	—	—	—	—	MOTOR D.C. 230 VOLTS	241	TC 260
2 678	—	—	—	—	—	MOTOR D.C. 115 VOLTS	271	TC 490
—	—	—	—	—	—	TRANSMITTING UNIT	101	TC 199

CONTRACT NOs 80646 DATED 8 JAN. 1941 & CONT. NO. NKS-18237

SPARE PART BOX								NAVY TYPE DESIG.	ALL SYMBOL DESIG. INVOLVED	DESCRIPTION	CONTRACTOR'S DWG. & PART NUMBER
1	2	3	4	5	6	115V-DC	230V-DC	CAY 21681		MOTOR SPARES	
-	24	-	-	-	-	X		O-241		BALL BEARING MRC #306 WF	33-J-178 IT.7
-	80	-	-	-	-	X		E-243		D.C. BRUSHES	33-J-178 IT.70
-	40	-	-	-	-	X		E-242		A.C. BRUSHES	33-J-178 IT.42
-	2	-	-	-	-	X		E-247		COMMUTATING FIELD COILS	33-J-178 IT.88
-	2	-	-	-	-	X		E-244		SHUNT FIELD COILS	33-J-178 IT.87
-	2	-	-	-	-	X		E-245		D.C. BRUSH HOLDERS	33-J-178 IT.122
-	1	-	-	-	-	X		E-249-A		D.C. BH. SPRING	33-J-178 IT.74
-	2	-	-	-	-	X		E-246		A.C. BRUSH HOLDER-RIGHT HAND	33-J-178 IT.120
-	2	-	-	-	-	X		E-246 (A)		A.C. BRUSH HOLDER-LEFT HAND	33-J-178 IT.121
-	2	-	-	-	-	X		E-249 (A)		A.C. BH. SPRING	33-J-178 IT.145
-	SET	-	-	-	-	X		E-248		D.C. BH.ROD INSULATION	33-J-178 IT.66 & 83
-	2	-	-	-	-	X		E-249		A.C. BH INSULATION	33-J-178 IT.56 & 60
-	-	1	-	-	-	X		E-250		ARMATURE 230 VOLTS, 22 AMP. D.C. 162 VOLTS 3.3 AMP. A.C.	33-J-178 IT.117
-	SET	-	-	-	-	X		O-242		BEARING PULLER PARTS	33-J-178 IT.125

USED TO PULL ANY BEARING ON W-G SET. TAGGED WITH THE SYMBOL NUMBERS ON PKGS. 33-J-178 AND 33-J-178.
ANY OF THE FOLLOWING BEARINGS MAY BE USED-MRC 306MFORSF-ND7306 OR ND7606.

23. EXCEPTIONS TO NAVY SPECIFICATIONS
    THE GENERATOR DESCRIBED HEREIN CONFORMS TO THE DETAILED SPECIFICATIONS AS MODIFIED BY THE SPECIFICATIONS R-1135 ADD. A & B AND CONTRACT NO80646 IN ALL RESPECTS SAVE THE FOLLOWING - NONE

NAVY SPECS. TO BE OF DATE OF LATEST ISSUE.

ALL ALUMINUM SURFACES MUST BE PROTECTED WITH ONE COAT ZINC CHROMATE PRIMER AND TWO COATS OF ALUMINUM PAINT CONSISTING OF ALUMINUM POWDER N.D. SPEC. 52A1, 2 POUNDS, AND ALUMINUM SPAR MIXING VARNISH N.D. SPEC. 52V15, 1 GALLON PER 17#9d PARc-2c (FIN. #25).

ALL STEEL BOLTS, NUTS, WASHERS, PINS, SPRINGS AND PLUGS TO BE PROTECTED AGAINST CORROSION AS PER SPEC. R-1135 ADDENDA A & B PAR 2-6

(.190 DIA.) THREADS TO BE NATIONAL FINE SERIES. ALL OTHER THREADS TO BE NATIONAL COARSE THREAD SERIES - UNLESS OTHERWISE SPECIFIED.

ALL THREADS TO BE FIT #3 PER 17#9d PAR C-7e(3).

DIO FISHPAPER CELL
NAVY SPEC-17-F-11

CROSS SECTION OF ARMATURE SLOT

LIST OF MATERIAL
QUANTITIES ARE FOR ONE MACHINE

PIECE NO	SYMBOL NO	NAME OF PIECE	NUMBER WANTED	MATERIAL	MATERIAL SPECIFICATION	DRAWING NUMBERS CONTRACTOR	DRAWING NUMBERS BUREAU	STYLE NO
60		5/16-18X3-1/4HEX.HD.BOLT	2	STEEL	43-B-11 FIT#3			
61		5/16 HEX. NUT	2	STEEL	43-B-11 FIT#3			
62	E-249	INSULATING SPACER	2	FIBRE				
					2-B-9099			
63		5/16 WIDE WASHER	2	STEEL	43-W-1			779359
64	E-248	INSULATING WASHER	8	FIBRE	17-F-5 GRADE BH	18A66A		334527
65	E-248	INSULATING TUBE	4	MICARTA	NONE	299138		785465
66		B.H.ROD	4	C.R.STEEL	46-S-17 CLASS B	342556		1124780
67		1/2 EYE BOLT	1	STEEL	46-S-6 CLASS C1			
68		B.H. ROD CAP	4	C.R.SM.STEEL	47-S-11 GRADE A			187338
69	C-245	BRUSH HOLDER	*	BRASS	47-B-2	212147		
70	E-243	CARBON BRUSH	8	CARBON	17-B-8 GRADE B			917122
71	E-245	B.H. STUDIE	*	STEEL	47-S-11 GRADE A	3A1652		273265
72	E-245	B.H.PIN	*	PHOSPHONZE	46-A-27 FIT#4	245046		329188
73	E-245	B.H.PIN LEVER	*	B.&S. SPRING STEEL WIRE	NONE	245046		
74	E-249 12454	B.H. SPRING	*	CLOCK SPRING	NONE	230728		282836
75	E-245	1/4-20X1 FIL.HD.I.W.SC.	*	STEEL	42-S-5 FIT#3			
76		SPACER	1	STEEL TUBING	44-T-1 SEAMLESS	1-D-9239		
77	E-245	1/4 HEX. NUT	*	BRASS	43-B-11 FIT#3			
78		1/4-20-3/4X1/4FIL. HD B.W.SC	*	BRASS	42-S-5 FIT#3			
79		.190 LOCK WASHER	*	STEEL	NONE			
80		PERFORATED COVER	FRONT END BOTTOM 3	SHEET STEEL	47-S-11 GRADE A	11-B-439		
81		FRONT&REAR TOP COVERS-SOLID	1	SHEET STEEL	47-S-11 GRADE A	11-B-439		
82		GASKET	5	CORK	NONE	5D7928		
83		VRE COVERS-FR.W.SIDE	2	SHEET STEEL	47-S-11 GRADE A	11-B-439		
84		.190-32X1/2FIL.HD.IN.SC.	36	STEEL	42-S-5 FIT#3			
85		MAIN POLE COMPLETE	4	SHEET STEEL	47-S-11 GRADE A	1-D-3519		
86		COMMUTATING POLE	2	M.R.STEEL	46-S-6 CL.A	1-D-3520		
87	E-248	SHUNT COIL	4	CL.WIRE	15-M-2 ENAM.	L-367058		
88	E-243	COMMUTATING COIL	2	SQUARE COPPER WIRE	NONE	L-367058		
89		3/8-16X1-1/4HEX.HD.BOLT	10	STEEL	43-B-11 FIT#3			
90		3/8 LOCK WASHER	24	STEEL	NONE			
91		3/8X16.3HEX.HD.BOLT	2	STEEL	43-B-11 FIT#3			
92		3/8-16X1-1/4HEX.HD.BOLT	8	STEEL	43-B-11 FIT#3			
93		3/8 WASHER	8	STEEL	43-W-1			
94		BUSHING	1	FULLER BOARD	NONE	832135		
95		TERMINAL BOARD	1	MICARTA	17-P-5 GRADE BT	74-C-167		
96		TERMINAL BOX	1	M.I.	46-C-8 TYPE A	2-B-9010		
97		TERMINAL BOX COVER	1	M.I.	46-C-8 TYPE A	48-C-430		
98		PIN,#10IA. X 3/8	1	C.R.STEEL	46-S-17 CLASS B	97-C-638		
99		.190 WASHER	4	STEEL	43-W-1			
100		5/8-16 X5/8 FIL.HD.I.W.SC.	4	STEEL	42-S-5 FIT#3			
101		1/4-20X3/4HEX.HD.BOLT	6	STEEL	43-B-11 FIT#3			
102		.190-32X1-1/4FIL.HD.BW.SC	5	BRASS	42-S-5 FIT#3			
103		.190 WASHER	25	BRASS	43-W-1			799358
104		TERMINALS	10	COPPER TUBE	WW-T-799 TYPE K			229105
105		.190-32 HEX.BRASS NUT	15	BRASS	15-S-5 FIT#3			
106		LEAD BUSHING	1	RUBBER	NONE			527013
107		GREASE CUP	2	STEEL	NONE			#295085
108		AIR SHIELD	1	SH.STEEL	47-S-11 GRADE A	1-D-9192		
109		KEY 1/4 X 1/4 X 1-1/8	1	C.R.STEEL	46-S-17 CLASS B	97-C-638		
110		NAME PLATE(24256 KEYBOLT)	1	NICKELSILVER	RE-13-A-516			
111		NAME PLATE(24256 LUBRICATION)	2	NICKELSILVER	RE-13-A-516			
112		NAME PLATE (24257 (ROTATION)	1	NICKELSILVER	RE-13-A-516			
113	E-248	#611 CEMENT	1 SET	ASPHALT	NONE			
114		FRONT BRG. ASSEM.				97-C-559		
115		REAR BRG. ASSEM.				97-C-512		
116		TERMINAL BOX ASSEM.				2-B-9102		
117	E-250	ARMATURE ASSEM.				2-B-9098		
118		COLLECTOR ASSEM.				74-C-368		
119		KEY 1/4SQ.X1 IN. LG.	1	CR. STEEL	46-S-17 CLASS B	97-C-638		
120	E-246	F.H. B.H. ASSEM(COLLECTOR)	2			1-D-9398		1124417
121	E-247	L.H. B.H. ASSEM(COLLECTOR)	2			1-D-9198		1124418
122	E-245	D.C. BRUSH HOLDER	8			212147		271764
123		BLOWER	1	STEEL SHEET	47-S-11 GRADE A	7-B 8141		
124		3/8X2 HEX HD S BOLT	2	STEEL	43-B-11 FIT#3	7-B 8141		
125	O-242	BEARING PULLER PARTS	1 SET			97-C-683		
126		3/8 LOCKWASHER	2	STEEL	NONE	7-B 8141		
127								
128		BUSHING	2	BRASS	41-0-2	8-A-2954		
129		1/8 PIPE NIPPLE - 3-1/2 LONG	1	STEEL	44-P-10 GALV	97 C 512		850164
130		1/8 PIPE COUPLING	1	STEEL	NONE	97 C 512		#295570
131		1/8 PIPE CLAMP	1	STEEL	NONE			5344
132		CLAMP SPACERS	10	STEEL	NONE	9-D 9906		1306971
133		.190-32X1 FIL HD I.M. SCREW	2	STEEL	42-S-5 FIT#3			
134		.90 LOCK WASHER	2	STEEL	NONE			

* IT. 122, S#271764 CONSISTS OF 1 EACH OF ITEMS 51,69,71,72,73,74,75,77,78,79 OF DWG. 33-J-178.
\# IT. 120 S#1124417 CONSISTS OF 1 EACH OF ITEMS 43,44,45,46,47,48,78,79 OF DWG 33-J-178.
△ IT. 121 S#1124418 CONSISTS OF 1 EACH OF ITEMS 32,33,45,46,47,78,79 OF DWG. 33-J-178.

ø EXCEPT ROLLED BAR. 18S ELONGATION IN 2 IN., 30S REDUCTION OF AREA, BENDS 180° ON 1-1/2 X DIAMETER.

\# THIS MATERIAL IS EQUIVALENT TO OR BETTER THAN THE COMMERCIAL GRADE KNOWN AS SILICON STEEL, ELECTRICAL GRADE.

+ EXCEPT SRIINEL 75 UP TO 1/8 THICK.

⊕ SURFACE INSPECTION ONLY

⊕ ANY OF THE FOLLOWING BEARINGS MAY BE USED-MRC 306 MF OR SF, ND 7306 OR ND 7606.

LIST OF MATERIAL
QUANTITIES ARE FOR ONE MACHINE

PIECE NO	SYMBOL NO	NAME OF PIECE	NUMBER WANTED	MATERIAL	MATERIAL SPECIFICATION	DRAWING NUMBERS CONTRACTOR	DRAWING NUMBERS BUREAU	STYLE NO
1		FRAME	1	STEEL	46-S-5 GRADE F	2-B-9097		
2		FRONT BRACKET	1	MICRON	46-18 TYPE A	5 A 7672		
3		REAR BRACKET	1	MICRON	46-18 TYPE A	5-A 9821		
4		SHAFT	1	M.R.STEEL	46-S-17 CLASS C-4	97 -638		
5		INSIDE CAP	2	M.I.	46-I-8 TYPE A	7-D 7938		
6		IMPELLER	2	STEEL	46-S-11C.CLASS B	7-D 7936		
7	O-241	BALL BEARING #306-WF-MRC	2		42-B-5 ⊕			1133077
8		LOCK WASHER	2	SH. STEEL	47-S-11 FIT#4	8J6083		572670
9		LOCK NUT	2	C.R. STEEL	46-S-17 CLASS B	8J6082		572679
10		1/8 PIPE PLUG	2	STEEL	45-F-2			
11		5/16-18X2-1/4HEX.HD.BOLT	8	STEEL	43-B-11 FIT#3			
12		5/16 LOCKWASHERS	10	STEEL	NONE			
13		ROTOR PUNCHINGS	1 SET	STEEL			1-D-9188	
14		ROTOR PUNCHINGS	1 SET	STEEL			1-D-9188	
15		KEY 1/4 X 1/4 X 5-1/2	1	C.R.STEEL	46-S-17 CLASS B	97 -638		
16		BANDING WIRE .029 DIA.		STEEL	NONE	2-B-9089		
17		NAME PLATE #32504	1	NICKELSILVER	RE-13-A-516			
18		ESCUTCHEON PINS #1233/8	16	BRASS NICKEL PLATED	NONE			
19		ARMATURE COIL	27	COPPER	45-M-2 D.C.C.	A D 7029		
20		INSULATION	2			320001		
21		TIN CLIPS	45	TINNED SHEET STEEL	QQ-T-306 TYPE I			
22		COMMUTATOR VEE-RING	1	M.R.STEEL	46-S-6 CL.B SPEC	1-D-9189		
23		COMMUTATOR BAR	107	COPPER	47-C-2 TYPE A HARD	1-D-9190		
24		COMMUTATOR BAR (MICA)	207	MICA	27-M-5 GRADE A FORM III	1-D-9190		
25		MICA VEE-RING	2	MICA	27-M-5 FORM III GRADE A	492240		
26		COMMUTATOR BUSHING	1	M.R.STEEL	46-S-6 CL.B SPEC	1-D-9191		
27		COMMUTATOR NUT	1	M.R.STEEL	46-S-6 CL.B SPEC	2B-9192		284869
28		INSULATING RING	1	FIBRE	17-F-5 GRADE BH	2-D-4638		
29		CORD	1 SET	FLAX TWINE	NONE			
30		INSULATION	1 SET		NONE	320001		
31		INSULATION	1 SET		NONE	320001		
32	E-247	BRUSH HOLDER L.H.	△	BRASS	NONE	1-D-9193		
33	E-247	B.H.FINGER L.H.	△	STEEL	47-S-11 GRADE A FIN #3	2B-8-828		
34		BUSHING	2	RUBBER	NONE	876477		445223
35		COLLECTOR BUSHING	1	M.R.STEEL	46-S-2 FIT#3	1-D-9197		
36		COLLECTOR SLEEVE	1	C.R.SM.STEEL	47-S-1 GRADE A	1-D-9197		
37		INSULATION-MICA	6	MICA	27-M-5 FORM III GRADE B	1-D-9276		
38		COLLECTOR RINGS	2	BRASS	46-M-6	6 D 6157		
39		INSULATION TUBE	2	MICARTA	17-P-5 GRADE BT	48-C-395		
40		CONNECTOR	2	COPPER	NONE	48-C-395		
41		INSULATION	1 SET		NONE	320001		
42	E-242	CARBON BRUSH	4	CARBON	17-B-8 GRADE B			2133017
43	E-246	BRUSH HOLDER R.H.	*	BRASS	NONE	1-D-9193		
44	E-246	B.H.FINGER R.H.	*	STEEL	47-S-11 GRADE A FIN #3	2B-8-828		
45	E2246 E2248	B.H. SPRING	⊕△	SPRINGSTEEL	NONE	5-B-215		848058
46	E246 E243	WASHER	⊕△	STEEL	43-W-1	857940		699840
47	E246 E243	1/16 SPRING COTTER	⊕△	STEEL	42-P-7			
48	E246 E243	POST	⊕△	STEEL	46-S-17 CLASS B	2B-8-828		
49		B.H.ASSEMBLY CLAMP	△	STEEL	46-S-17 CLASS B	2-B-9099		
50		1/4-20X1-1/4HEX.HD.BOLT	8	STEEL	43-B-11 FIT#3			
51	E-245	1/4 LOCK WASHERS	*△	STEEL	NONE			
52		3/16X7/16LGR.MOS RIVET	△	STEEL	43-B-11			
53		B.H.BASE	2	STEEL	46-S-17 CLASS B	2-B-9099		
54		SPACER	2	STEEL	46-S-17 CLASS B	2-B-9099		
55		B.H.ARM.	2	STEEL	46-S-17 CLASS B	2-B-9099		
56	E-249	INSULATING WASHER	6	FIBRE	17-F-5 GRADE BH	2-B-9099		
57	E-249	INSULATING TUBE	2	MICARTA	NONE	2-B-9099		
58	E-249	INSULATING SPACER	2	FIBRE	NONE	2-B-9099		
59	E-249	INSULATING WASHER	4	FIBRE	17-F-5 GRADE BH	2-B-9099		

Figure 49—Specifications, D.C. Motor, Type CAY-21681, a Part of Motor-Generator Set, Type CAY-21676, CAY-T-155, Sheet 30 (Dwg. 33-J-178)

(A) MFD. BY - WESTINGHOUSE ELEC. & MFG. CO. CLASS - 6111-S27
PLAN NO. 45-J-408

(B) THE EQUIPMENT SHOWN ON THIS PLAN IS IN ACCORDANCE WITH NAVY DEPARTMENT SPEC. 17-C-17.

(C) EXCEPTIONS TO M.D. SPEC. 17-C-17 AND REFERENCE SPECIFICATIONS ARE - NONE

(D) DESCRIPTIVE DATA OF CONTROLLER
(1) ENCLOSURE - DRIP-PROOF
(2) RATING - 5 H.P., 230V., D.C., 22 AMPS. F.L., SIZE 2
(3) OPERATION - MAGNETIC
(4) TYPE - RESISTOR
(5) FUNCTION - MOTOR STARTING
(6) DUTY - CONTINUOUS
(7) PROTECTION - LOW VOLTAGE RELEASE
OVERLOAD PROTECTION
(8) PERFORMANCE - SEMI-AUTOMATIC
(9) SERVICE - A (MI SHOCK)
(10) AMBIENT - 50°C. MAX.
(11) INSULATION - CLASS A

(E) DESCRIPTIVE DATA OF ASSOCIATED EQUIPMENT -
(1) MASTER SWITCH - LOCATED ON TRANSMITTER

(F) DESCRIPTIVE DATA OF DEVICES
(1) OVERLOAD RELAY
(A) TYPE - THERMAL, BIMETALLIC
(B) COMPENSATION - LESS THAN 3% ERROR PER 10°C. AMBIENT CHANGE
(C) ADJUSTABILITY - 90% TO 110% OF RATING
(D) TYPE OF RESET - HAND
(E) RESETTING TIME - 45 SECONDS OR LESS
(F) OPERATION - THE SINGLE POLE RELAYS ARE EQUIPPED WITH RENEWABLE HEATERS. THE HEAT IS TRANSMITTED TO A HELICAL BIMETAL WHICH ROTATES AND AT A GIVEN TEMPERATURE RELEASES THE SPRING CLUTCH, WHICH IN TURN PERMITS THE TRIP SPRING TO OPEN THE CONTACTS.
(2) OVERLOAD HEATER - HEATER CODE MARKING - A-26.0
MOTOR LOAD RANGE AMPERES - 20.8 TO 22.9
(3) SHUNT COILS - SEE SHUNT COIL TABLE
(4) RESISTORS - SEE RESISTOR TABLE

(G) WEIGHTS
(1) CONTROLLER WEIGHT LBS.
(2) SPARE PARTS (UNBOXED) 5 LBS.

(H) NOTES -
(1) 50°C. TEMPERATURE RISE (50°C. AMBIENT) GIVEN GENERAL APPROVAL FOR SHUNT COILS BY BU. SHIPS LETTER NO. S62-(13) 350 BU. ORD. LETTER NO. S62-(Re5c) DATED 29, JULY 1943.
(2) RATING OF RESISTORS LISTED IN THE RESISTOR TABLE ARE BASED ON A DUTY CYCLE OF 5 SECONDS OUT OF 80 SECONDS REPEATED FOR 4 CONSECUTIVE STARTS.

LIST OF SPARE PARTS
NAVY TYPE CAY 211232
MODEL TBM-11-12/TBK-20 TRANSMITTING EQUIPMENT
MAGNETIC CONTROLLER FOR MG SET

MFGS. PLAN NO. 45-J-408 SUB. NO. 6
BU. SHIPS PLAN NO. MFG. WESTINGHOUSE ELEC. & MFG. CO.

PIECE NO.	NO. PER SET	ALL SYMBOL DESIGNATION INVOLVED	NAME OF SPARE PARTS	MFGS. DATA STYLE NO.	MFG. INFO. PC.	MFG. INFO. DWG.
1			1M-220 CONTACTOR			
1A	2	K-851B, C	MAIN STATIONARY CONTACT	1303972	1	37-J-922
1B	2	K-851B, C	MAIN MOVING CONTACT	1303971	2	37-J-922
1C	2	K-851G	MAIN CONTACT SPRING	1308159	3	37-J-922
1D	1	K-858H	KNOCKOUT SPRING	1308163	6	37-J-922
2			1M-220 CONTACTOR COIL			
2A	1	K-861A	COIL (230V. D.C.)	1303532	5	37-J-922
3			N.O. INTERLOCK			
3A	2	K-851E	STATIONARY CONTACT	1308250	6	37-J-922
3B	1	K-851E	MOVING CONTACT	1308251	7	37-J-922
3C	1	K-851J	SPRING	1308164	8	37-J-922
4			N.C. INTERLOCK			
4A	2	K-851D	STATIONARY CONTACT	1308214	9	37-J-922
4B	1	K-851D	MOVING CONTACT	1308317	10	37-J-922
4C	1	K-851K	SPRING	1297369	11	37-J-922
5			N.C. INTERLOCK (SPECIAL)			
5A	2	K-861F	STATIONARY CONTACT	1308181	12	37-J-922
5B	1	K-861F	MOVING CONTACT	1257419	13	37-J-922
5C	1	K-861L	SPRING	1289042	14	37-J-922
6			IAQ-4111 RELAY (1N.O. & 1N.C. CONTROL CONTACT)			
6A	2	K-852B, K-853B	MAIN MOVING CONTACT	1308319	1	37-J-890
6B	2	K-852B, K-853B	MAIN STATIONARY CONTACT	1308318	2	37-J-890
6C	2	K-852F, K-853F	RETURN SPRING	1258957	3	37-J-890
6D	2	K-852G, K-853G	ARMATURE SPRING	1258963	4	37-J-890
6E	4	K-852C, K-853C	N.O. CONTROL CONTACT STATIONARY CONTACT	1258707	6	37-J-890
6F	2	K-852C, K-853C	MOVING CONTACT	1257419	7	37-J-890
6G	2	K-852H, K-853H	SPRING	1289042	8	37-J-890

CONTROLLER S.O.	4-8-8890	4-8-8917	9-Y-4045	9-Y-5874	WHEN REORDERING REFER TO MFGS. DATA
SPARE PARTS S.O.	4-8-8891	4-8-8918	9-Y-4046	9-Y-7726	

CASE NO. GROSS WT. NET WT. SHEET 1 OF 2

LIST OF SPARE PARTS
NAVY TYPE CAY 211232
MODEL TBM-11-12/TBK-20 TRANSMITTING EQUIPMENT
MAGNETIC CONTROLLER FOR MG SET

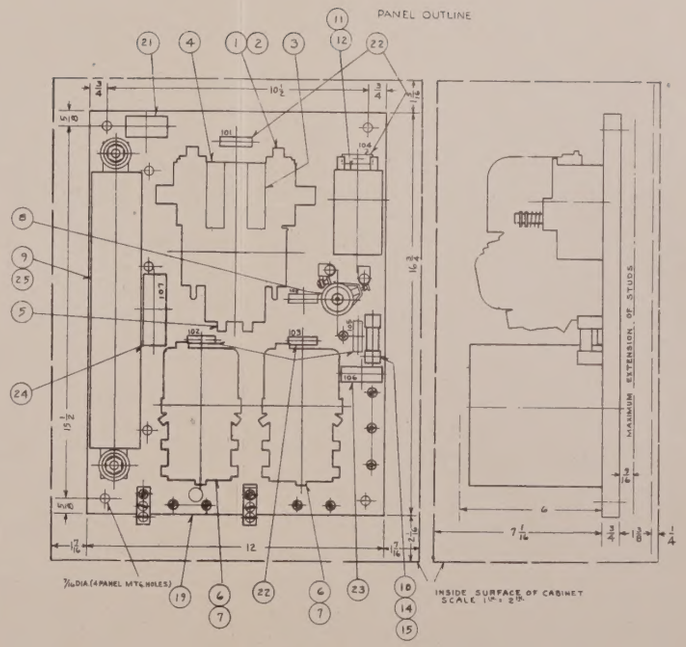
MFGS. PLAN NO. 45-J-408 SUB. NO. 6
BU. SHIPS PLAN NO. MFG. WESTINGHOUSE ELEC. & MFG. CO.

PIECE NO.	NO. PER SET	ALL SYMBOL DESIGNATION INVOLVED	NAME OF SPARE PARTS	MFGS. DATA STYLE NO.	MFG. INFO. PC.	MFG. INFO. DWG.
6M	4	K-852D, K-853D	N.C. CONTROL CONTACT STATIONARY CONTACT	1258708	9	37-J-890
6J	2	K-852D, K-853D	MOVING CONTACT	1312152	10	37-J-890
6K	2	K-852E, K-853E	SPRING	1312162	11	37-J-890
7			IAQ-4120 & 4110 RELAY COIL			
7A	1	K-852A, K-853A	COIL (230V. D.C.)	1316381	5	37-J-890
8			POTENTIOMETER RESISTOR			
8A	1	R-853	RESISTOR UNIT	884241		
9			STARTING RESISTOR			
9A	1	R-851	RESISTOR UNIT	1312911		
10			CONTROL FUSE (10A., 250V.)			
10A	10	F-851	FUSE	37160		
11			M.I. OVERLOAD RELAY HEATER			
11A	1	K-854 A	HEATER (26.0 AMPS)	1265727	22	36-J-639

CONTROLLER S.O.	4-8-8890	4-8-8917	9-Y-4045	9-Y-5874	WHEN REORDERING REFER TO MFGS. DATA
SPARE PARTS S.O.	4-8-8891	4-8-8918	9-Y-4046	9-Y-7726	

CASE NO. GROSS WT. NET WT. SHEET 2 OF 2

PANEL OUTLINE



LIST OF MATERIAL
QUANTITIES ARE FOR ONE CONTROLLER

PIECE NO.	NAME OF PIECE	REQ'D NO.	MATERIAL	MATERIAL SPECIFICATION	REMARKS
1	1M-220 CONTACTOR	1	ASSEMBLY	17-C-17	
2	COIL FOR PC. NO. 1 (250V. D.C.)	1	EN. WIRE	15-A-2	S-1303532
3	N.O. INTERLOCK FOR PC. NO. 1	1	ASSEMBLY	17-C-17	
4	N.C. INTERLOCK FOR PC. NO. 1	1	ASSEMBLY	17-C-17	
5	N.C. INT. (SPECIAL) FOR PC. NO. 1	1	ASSEMBLY	17-C-17	
6	IAQ-4111 RELAY WITH 1N.O. & 1N.C. CONTROL CONTACT	2	ASSEMBLY	17-R-6	
7	COIL FOR PC. NO. 6 (230V. D.C.)	2	EN. WIRE	15-A-2	S-1315391
8	POTENTIOMETER RESISTOR	1	RESISTOR	17-R-4	
9	STARTING RESISTOR	1	RESISTOR	17-R-4	S-1312983
10	CONTROL FUSE (10A., 250V.)	1	FUSE	37-F-2 TYPE 2N	
11	HEATERS FOR MI O.L. RELAY	1	ASSEMBLY	17-R-6	S-1265727
12	MI O.L. RELAY	1	ASSEMBLY	17-R-6	
13	MI O.L. RELAY RESET ASSEMBLY	1	ASSEMBLY	17-C-17	
14	FUSE CLIP	1	PH. BRONZE	46-B-14	
15	FUSE REINFORCING BRACKET	2	STEEL	COMM'L.	
16	CONTROL CONN. 24© OF 0.081 DIA. WIRE #7419-1	1	EL. CABLE	15-C-1	
17	MAIN CONN. 48" OF 0.129 DIA. WIRE #7419-1	1	EL. CABLE	15-C-1	
18	RES. CONN. 35" OF 0.102 DIA. WIRE #7419-3	1	EL. CABLE	15-C-1	
19	PANEL	1	PHENOLIC	47-P-3 TYPE FBG	
20	DRIP-PROOF CABINET	1	ASSEMBLY	17-C-11	
21	NAMEPLATE #18352	1	ZINC	46-N-TYPE AC	
22	NAMEPLATE	6	PHENOLIC	47-M-5 TYPE C	S-1310046
23	NAMEPLATE	1	PHENOLIC	46-M-5 TYPE C	S-1310047
24	NAMEPLATE	1	PHENOLIC	46-M-5 TYPE C	S-1310048
25	HEAT INSULATOR	1	ASBESTOS	COMM'L.	
26	NAMEPLATE	1	PHENOLIC	46-N-5 TYPE C	SEE COMBINATION TABLE
27	SIZE #2 MAGNETIC CONTROLLER	1	ASSEMBLY	17-C-17	LINE 1 DWG. 9-A-3883
28					
29					
30					
31	WIRING DIAGRAM	1			

SHOP NOTE - STAMP 1/8" HIGH TERMINAL MARKINGS ON FRONT OF PANEL TO AGREE WITH TERMINAL MARKINGS ON THE WIRING DIAGRAM.

* STAMP PER LINES 101 TO 105 & 108 OF NAMEPLATE STAMPING TABLE
+ STAMP PER LINES 106 OF NAMEPLATE STAMPING TABLE
# STAMP PER LINES 107 OF NAMEPLATE STAMPING TABLE
○ PIECES INCLUDED IN PIECE NO. 27
~ SHOP NOTE - ORDER BLACK & WHITE PRINT OF DIAGRAM AND PASTE IN CABINET DOOR PER PROCESS SPECIFICATION 290539.

SHUNT COIL TABLE

STYLE NO.	VOLT	WKG.	OHMS	TURNS	WIRE DATA	COIL DATA	USE
S-1303532	230	S-T	200	3520	#33 EN. CU. 50.13 C.M.	VACUUM IMPREGNATED	PC. NO. 2
		T-F	4850	26700	#36 EN. CU. 25 C.M.		
S-1315391	230	W	980	8000	#28 EN. CU. 39.75 C.M.	VACUUM IMPREGNATED	PC. NO. 7
		H	500	2100	#36 EN. CU. 25 C.M.		

RESISTOR TABLE

COMPLETE RESISTOR STYLE NO.	RESISTOR UNIT STYLE NO.	STEP RES.	OVERALL RES. PER UNIT	AMP. RATING	USE NO. UNITS	USE TOTAL RES.	USE SYMBOL	USE H.P.
1312983	1312911	2	3	35	2/3	2	R1-R2	5
		1			1/3	1	R2-R3	
884241	884241	---	400	--	1	400	R2-R3	---

DESCRIPTION OF OPERATION

THE M.G. SET IS STARTED BY THE CLOSING OF THE STARTING RELAY AT THE TRANSMITTER. THIS WILL SUCCESSIVELY ENERGIZE THE MAIN WINDING OF ACCELERATING RELAY COILS *K-852M* AND *K-853M* AND MAIN CONTACTOR COIL *K-851A*. STARTING THE MOTOR WITH RESISTANCE *R1-R3* IN SERIES WITH THE ARMATURE. INTERLOCK *K-851F* WILL DISCONNECT THE MAIN WINDING OF COIL *K-852M*, HOWEVER THE HOLDING WINDING *K-852M* WILL BE ENERGIZED SUFFICIENTLY TO KEEP MAIN CONTACT *K-852B* CLOSED UNTIL THE MOTOR CURRENT DROPS TO 125% OF FULL LOAD, THEN MAIN CONTACT *K-852B* CLOSES AND SHORTS OUT RESISTOR *R1-R2*. NORMALLY OPEN CONTROL CONTACT *K-852C* OPENS AND DISCONNECTS THE MAIN WINDING OF COIL *K-853M*, HOWEVER THE HOLDING WINDING *K-853M* WILL BE ENERGIZED SUFFICIENTLY TO KEEP MAIN CONTACT *K-853B* FROM CLOSING UNTIL THE MOTOR CURRENT AGAIN DROPS TO 125% OF FULL LOAD, THEN MAIN CONTACT *K-853B* CLOSES AND THE ARMATURE IS CONNECTED ACROSS THE LINE.

CONTROL CONTACTS *K-852D* AND *K-853D* ARE PROVIDED FOR CONNECTION INTO TRANSMITTER CIRCUITS.

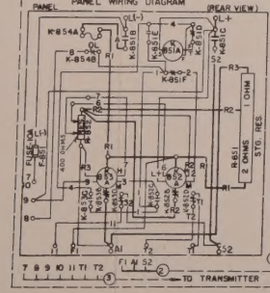
COIL *K-851A* HAS TWO WINDINGS CONNECTED IN SERIES. NORMALLY WINDING *F1-F2* IS SHORT CIRCUITED BY INTERLOCK *K-851D*, BUT AFTER CONTACTOR *K-851* PICKS UP, *K-851D* OPENS AND BOTH COIL WINDINGS ARE IN SERIES.

ACCELERATING RELAYS *K-852* AND *K-853* HAVE TWO WINDING COILS. WINDING *K-852AM* (OR *K-853AM*) IS ENERGIZED BY THE LINE VOLTAGE AND IS USED TO CLOSE THE MAGNET ARMATURE. WINDING *K-852AH* (OR *K-853AH*) IS ENERGIZED BY A PORTION OF THE VOLTAGE DEVELOPED ACROSS STEP *R2-R3* OF THE STARTING RESISTOR AND THEREBY MEASURES MOTOR CURRENT. THE ACCELERATING RELAY DROPOUT CURRENT MAY BE VARIED BY AN ADJUSTABLE POTENTIOMETER RESISTOR *R-852*. THIS CURRENT VALUE SHOULD BE SET NO LESS THAN 125% FULL LOAD.

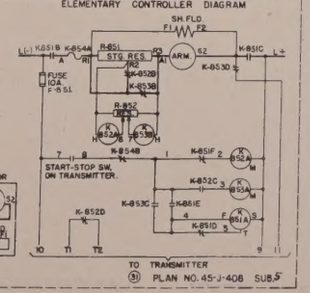
A SUSTAINED OVERLOAD, LOSS OF VOLTAGE, OR OPENING THE STARTING RELAY AT THE TRANSMITTER WILL DE-ENERGIZE COIL *K-851A* AND DISCONNECT THE MOTOR. THE OVERLOAD RELAY IS RESET BY PRESSING THE "RESET-EMERG. RUN" BUTTON ON THE CABINET DOOR.

IN AN EMERGENCY, THE MOTOR MAY BE RUN WITH OVERLOAD BY HOLDING DOWN THE "RESET-EMERG. RUN" BUTTON.

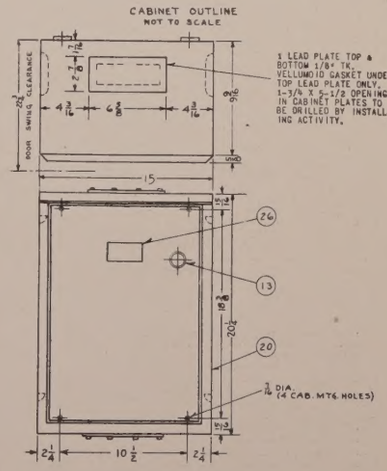
PANEL WIRING DIAGRAM



ELEMENTARY CONTROLLER DIAGRAM



CABINET OUTLINE
NOT TO SCALE


1 LEAD PLATE TOP & BOTTOM 1/8" TK. VELLUMOID GASKET UNDER TOP LEAD PLATE ONLY. 1-3/4 X 5-1/2 OPENINGS IN CABINET PLATES TO BE DRILLED BY INSTALLING ACTIVITY.
¾ DIA (4 CAB. MTG. HOLES)

NAMEPLATE STAMPING TABLE

LINE NO.	FIRST LINE	SECOND LINE	STAMP PER DWG. 8-D-4920 FIG. NO.	REQ. NO.
101	K-851	*	6	1
102	K-852		6	1
103	K-853		6	1
104	K-854		6	1
105	F-851		6	1
106	CONT. FUSE	10A. 250V.	5	1
107	R-851 RES. R1 TO R3		1	1
108	R-852		6	1

COMBINATION TABLE

COMB. NO.	MODEL NO.	ITEM FROM THIS PLAN REQ. 1	PC. NO. 26 NAMEPLATE SPECIFY S#
1	TBM-11TBK20	2-7-9-11-22 TO 24-26-27-31	40655
2	TBK-20	2-7-9-11-22 TO 24-26-27-31	41090
3	TBM-12	2-7-9-11-22 TO 24-26-27-31	41484

APPLICATION

CONTROLLER S.O.	COMB. NO.	
4-8-8890	1	
4-8-8917	1	
9-Y-4045	2	
9-Y-5874	3	
9-Y-9732		

APPROVAL STATUS

PC. NO.	PART	TEST RECORD PLAN MFG.	TEST RECORD PLAN BU. SHIPS	TEST RECORD PLAN BU. ORD.	BUREAU APPROVAL LETTER	DATE
1	1M-220 CONTACTOR	37-J-922	TR-81009	387690	SHIPS S62-2(350) ORD S62(Re5c)	9-8-43 (FINAL)
2	IAQ-4111 RELAY	37-J-890	TR-81010	437905	SHIPS S62-2(335) ORD. S62(Prif)	7-25-44 (FINAL)
12	MI OVERLOAD RELAY	36-J-639	TR-81001	330348	SHIPS S65-11(356) ORD. S62(Pr15)	5-12-44 (FINAL)
		X	X	X		

X - PLANS ARE NOT AVAILABLE FOR GENERAL DISTRIBUTION.

Figure 50—Outline, Assembly and Specifications, Magnetic Controller, Type CAY-211232, for 230 Volt D.C. Operation, CAY-T-155, Sheet 41 (Dwg. 45-J-408)

Figure 50—Outline, Assembly and Specifications, Magnetic Controller, Type CAY-211232, for 230 Volt D.C. Operation, CAY-T-155, Sheet 41 (Dwg. 45-J-408)